CHAPTER 3

Research approach, strategies and methods applied during the course of the investigation

3.1 Introduction

Chapter three, discusses the multiple method research approach and the motivation why it is the suitable approach to examine how the school curriculum and classroom teaching address the need for learners' awareness of hazards and disasters. The aim of Chapter three is to explain the research strategies used to address issues raised in chapter two and in particular to address the questions that were raised in Chapter one. The chapter focuses on data collection methods, sampling techniques, data collection and analysis methods and thereby provides motivation as to why a triangulation method was used in this particular study.

3.2 Research design: qualitative, quantitative and mixed methods research

Research is a process of systematic and methodical inquiry and investigation to increase knowledge. Cohen et al. (2000:38) identify key characteristics of research as systematic, controlled, empirical and self-correcting. Since discipline is established by developing a body of knowledge, every research should add new knowledge to the body of existing data. Amaratunga et al. (2002:18) identify the following specific conditions for research:

- Orderly investigation of a defined problem.
- Use of appropriate scientific methods.
- Gathering adequate and representative evidence.
- Employing logical reasoning in drawing conclusions on the basis of evidence.
- Demonstrating or proving the validity or reasonableness of conclusions made.
- Ensuring that cumulative results of research in a given area yield general principles or laws that may be applied with confidence under similar conditions in future.

Scott (2000:11) maintains that the field of education teems with disputes about the reliability of different research approaches with little attention paid to epistemology and ontology. Cohen et al. (2000:5), on the other hand maintain that two contending and competing views of social science, namely the traditional view and the interpretive view have been adopted in educational research and have resulted in different schools of thought. The traditional view maintains that educational research is concerned with discovering natural and universal laws regulating and determining individual and social behaviour. The interpretive view maintains that educational research emphasises how people differ from inanimate natural phenomena and from one another. Cohen et al. (2000:13) further argue that researchers adopt the traditional (objectivist) view by treating the world as a natural phenomenon, hard, real and external to an individual. They choose from a comparable range of traditional methods such as experiments, surveys, questionnaires. Others, favouring the more subjective approach and who view the social world as being much softer and personal will select from a comparable range of recent and emerging techniques such as accounts, participative techniques and personal constructs.

For the purpose of this study the interpretive view seems attractive since when dealing with human beings and individuals in particular, one has to consider their unique circumstances. An example that emanated from the literature review in this study is the whole issue of educator involvement in the teaching of hazards and disasters, noting that some individuals are more exposed to hazards on a daily basis, especially those working and staying within informal settlements.

Tashakkori and Teddlie (2003:3) maintain that there are three (main) methodological movements of social and behavioural research; the positivists, constructivist and mixed methodologist. Healy and Perry (2000:118) echo Guba and Lincoln's (1994) four scientific paradigms which are positivism, constructivism, critical theory and realism. Each paradigm has its own methodological, ontological and epistemological viewpoint and uses specific research strategies and data analysis techniques. Cohen et al. (2000:3) support the idea that ontological assumptions give rise to epistemological assumptions that in turn give rise to methodological considerations.

Cohen et al. (2000:11) also argue that the first paradigm characterised by positivism ideals is less successful in its application to the study of human behaviour where the immense complexity and the illusive and intangible quality of social phenomena contrast strikingly with the order and regularity of the natural world. Moreover, in the contexts of classroom and school research Scott (2000:16) argues that objectivity is of crucial importance to the study of education because it can be used to indicate the accuracy of validity and help to ensure that the researcher is free of biases such as human error, dishonest error, interest bound and belief system. Healy and Perry (2000:119) define positivism as a paradigm that dominates science and assumes that science quantitatively measures independent facts about a single reality.

Whereas positivism is concerned with quantitative research according to Healy and Perry (2000:119), the other three paradigms are much more relevant to qualitative research. Cohen et al. (2000:17) maintain that the opponents of positivism are united by their common rejection of the belief that human behaviour is governed by general and universal laws, and characterised by underlying regularities. The second and third paradigms characterised by constructivist and critical theory support the subjective stance of the researcher and maintain that the social world can only be understood from the standpoint of the individuals who are part of the ongoing action being researched. The proponents of the constructivism paradigm view truth as a particular belief system held in a particular context and believe that the world consists of multiple realities that people have in their minds. Critical theory emphasises social realities incorporating historically situated structures.

The proponents of the fourth paradigm, which is realism, believe that there is a real world to discover, even though it is only imperfectly apprehensible. To make a distinction between constructivism and realism, Healy and Perry (2000:120) argue that an intrinsic case study (used in constructivism) focuses on the case itself while in an instrumental case study (used in realism) the case is used to understand something else.

It is important to note that the four paradigms do not study the same phenomena as highlighted in Sale et al. (2002:44) who argue that they cannot be combined. The table below summarises the distinguishable features of these four paradigms.

Table 3.1: Scientific paradigms and their elements, (Healy and Perry: 2000)

Element	Positivism	Critical Theory	Constructivism	Realism
Ontology	Reality is real and apprehensible.	Virtual reality shaped by social economic, ethnic, political, cultural and gender values crystallised over time.	Multiple local and specific constructed realities.	Reality is real but only imperfectly and probabilistically apprehensible.
Epistemology	Objectivist: findings are true.	Value mediated	Subjectivist: created findings	Modified objectivist: findings probably true
Methodologies	Experiments/Surveys: verification of hypotheses; chiefly quantitative methods.	Dialogic/dialectical: researcher is a transformative intellectual change who chiefly changes the social world in which participants live.	Hermeneutical/ dialectical: the researcher is a passionate with participants within the world being investigated.	Case studies, convergent interviewing, triangulation interpretation of research issues in qualitative methods and quantitative methods.

In deciding on the appropriate paradigm, method and strategies to address the problem, the four paradigms of positivism, constructivism, and critical theory and realism theories as discussed above were considered. Based on the discussions above, the realism paradigm as described in Fig 3.1 by Healy and Perry (2000:125) fits well the intentions and goals of the study to determine the contribution of education in raising learners' awareness of, knowledge of and application in responding to hazards and disasters. Firstly, the ontological focus of realism assumes that the research deals with complex social phenomena involving reflective people. In this study the researched phenomena refer to hazards and disaster education of learners and fit the criteria of being complex. The assumption of this study is that whatever data collected need to be verified, corroborated and compared with data from other sources. Hence in this study data will be collected from literature and other document sources, educators and specialists in learning, curricula and disasters.

Qualitative and quantitative research approaches have been used as the most appropriate ways to develop new knowledge and the proponents of these two approaches have been at loggerheads with each other. See the description of Amaratunga et al. (2002:18) who state that philosophers of science and methodologies have been engaged in a long standing epistemological debate about how best to conduct research which centres on the relative value of two fundamentally different and competing schools of thought. Each of the methods is based on a particular paradigm, a patterned set of assumptions concerning reality knowledge (ontology) of that reality (epistemology) and particular ways of knowing about reality (methodology); and that the two methods do not study the same phenomena as highlighted in Sale et al. (2002:44).

According to Johnson and Onwuegbuzie (2004:18) quantitative research focuses on deduction, confirmation, theory/hypothesis testing, explanation, prediction, standardised data collection and statistical analysis. Amaratunga et al. (2002:19) point out that the quantitative approach grows out of a strong academic tradition that places considerable trust in numbers that represent opinions or concepts. Borkan (2004:4) is of the idea that quantitative data collection tools allow the researcher to infer only about that which he or she is examining and that the statistical technique may work best in isolating or identifying the correlates associated with variations at specific moments in time.

Sale et al. (2002:44) explain that the ontological position of the quantitative paradigm is that there is only one truth, an objective reality that exists independently of human perception while epistemologically the investigator and the investigated are independent entities, which implies that the investigator is capable of studying a phenomenon without influencing it or being influenced by it. Sandelowski (2000:248) maintains that in quantitative sampling, probability sampling is usually preferred to permit statistical inferences and that it is oriented toward the development of nomothetic knowledge from generalisations of samples to populations.

It is therefore important to note that quantitative research techniques are important in that they allow for generalisations from samples of populations. Amaratunga et al. (2002:19) maintain that quantitative research grows out of a strong academic tradition that places considerable trust in numbers that represent opinions or concepts. Here, the researcher develops a testable hypothesis and theory which can be generalised across settings. It is important to note that Sale et al (2002:50) view quantitative research as perceiving truth as something that describes objective reality separate from the observer waiting to be discovered. Johnson and Onwuegbuzie (2004:18) maintain that quantitative research focuses on deduction, predictions, standardised data collection and statistical analysis.

The aforementioned discussions on quantitative research, led to the decision that it would be beneficial for this study to implement some components of a quantitative research approach. For the purpose of this study a questionnaire was used as a component of the quantitative research technique which also necessitated the use of other components such as sampling techniques and statistical data analysis involving coding. The reason for using the quantitative research technique is grounded on the fact that the results are easy to summarise and analyse while they also allow for comparisons of groups, location and times. Quantitative research strategies also allow for data collected from a small group to provide an indication of the views of a larger population.

As for a qualitative research approach, Johnson and Onwuegbuzie (2004:18) maintain that it focuses on induction, discovery, exploration, theory/hypothesis generation, the researcher as the primary instrument of data collection and qualitative analysis. The idea is further supported by

Borkan (2004:4) who maintains that qualitative research has great potential for exploring new topics or when familiarising research teams with new topics and that it is categorised by data collection techniques such as interviews, focus groups, participant observation, narrative and lived experiences. Amaratunga et al. (2002:19) support the notion by stating that qualitative research concentrates on words and observation to express reality and attempts to describe people in natural settings.

Sale et al. (2002:45) maintain that the ontological position of a qualitative paradigm is that there are multiple realities or multiple truths based on one's construction of reality which is constantly changing and epistemologically there is no access to reality independent of our minds, no external referent by which to compare claims of truth while the investigator and the object of study are interactively linked, so that findings are mutually created within the context of the situation which shapes the inquiry. Sandelowski (2000:248) argues that qualitative researchers prefer to use purposeful sampling to enhance understanding of the information-rich case and that it is oriented toward the development of idiographic knowledge, generalisations from and about individuals. Qualitative research is an umbrella term for many kinds of research approaches and techniques, including ethnography, case studies, analytic induction, content analysis, hermeneutics and life histories.

According to Amaratunga et al. (2002:25) qualitative research interviews are the most widely used method in social research and it is a highly flexible method that can be used almost anywhere and is capable of producing data of great depth. It is further defined as a technique whose purpose it is to gather descriptions of the life world of the interviewee with respect to the interpretation of meaning of the described phenomena. Amaratunga et al. (2002:25) further argue that when the researcher's concern is the experiences of people, the way that they think, feel and act, the most truthful, reliable, complete and simple way of getting that information is to share their experiences which could be done through one-on-one interviews or a group interview, commonly known as a focus group.

In brief, the discussions above purport that researchers need to choose from either qualitative or quantitative research approaches to develop the knowledge required to solve an identified

problem. Liebermann (2005:435) argues that long-standing methodological tradeoffs in the main modes of comparative analysis have tended to force scholars to choose between one or two imperfect approaches and further argues that such back-and-forth debate has served to illuminate the shortcomings of various methodological approaches; it has also provided momentum for the synthesis of research styles and findings. The idea is supported by Johnson and Onwuegbuzie (2004:16) who argue that scholars have called for an alternative integrative research approach which has resulted in a trilogy of major research paradigms and they regard mixed method research as the third paradigm.

Sale et al. (2002:46) provide several reasons as to why qualitative and quantitative approaches should be combined. The first reason concerning the two approaches is that they can be combined because they share the same goal of understanding the world in which we live in unified logic. The second reason is that the two paradigms are compatible because they share the tenets of theory-laden facts, fallibility of knowledge, in-determination of theory by fact and a value-laden inquiry process, shared commitment to improving human conditions, a common goal of disseminating knowledge for practical use, a shared commitment to rigour and critique in the research process. The third reason is that the complexity of phenomena requires data from a large number of perspectives. Another reason that could be added here as the fourth is that research should not be preoccupied with the quantitative–qualitative debate because it will not be resolved in the near future; that epistemological purity does not get research done.

The prevalent idea in most mixed methods research is that researchers should forge ahead with what works because truth is normative and combining two or more theories or sources of data to study the same phenomenon would assist in gaining a better understanding of it. Johnson and Onwuegbuzie (2004:16), on the other hand, maintain that a mixed research method should instead use a method and philosophy that attempt to fit together the insights provided by the two approaches into a workable solution.

Borkan (2004:4) defines mixed method research as an approach that refers to those studies or lines of inquiry that integrate one or more qualitative and quantitative techniques while Johnson and Onwuegbuzie (2004:17) define it as the class of research where the researcher mixes or

combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study.

Sandelowski (2000:248) argues that a combination of methods is concretely operationalised at the technique level of research, such as the level of sampling, data collecting and data analysis because combination at the paradigm level is not true combination, merger or reconciliation. This argument is further emphasised by Sale et al. (2002:47) who question the studies that found agreement in their qualitative and quantitative research and ask whether the results can be similar if the two paradigms look at different phenomena. There is agreement among researchers that the combination of paradigms is problematic; however, a combination of techniques is possible and the most appropriate. Sandelowski (2000:248) argues that techniques are tied neither to paradigms nor methods and permit innovative uses of a range of techniques for a variety of purposes such as:

- triangulation, to achieve corroboration of data or convergent validation;
- clarification, to explain or to elaborate on the result analysis;
- development, to guide the use of additional sampling, and data collection and analysis techniques.

In light of the discussions above on qualitative, quantitative and mixed research methods, the third approach which advocates the combination of both the qualitative and quantitative has proved to be ideal for this study on hazards and disasters; the former ensured that data were collected from a wider population while the latter focused on a selected few to collect data with great depth. The next section focuses on the description of each method that was used in this study.

3.3 Data collection through documents review, questionnaires and interviews

3.3.1 An overview of data collection methods used in this study

Three methods of data collection were selected for this study: an in-depth study of literature and documents review, questionnaires and interviews. Through literature study and documents

review data were collected from policy documents, such as curriculum guidelines, statements and legislation, disaster legislation, research articles on curriculum and hazards and disasters education and any other sources such as websites and newspapers. In essence any information that helped to provide reliable data to answer the main research question as stated in Chapter one of this study was used. The questionnaires were completed by 150 respondents in five provinces, KwaZulu-Natal, Eastern Cape, Western Cape, Gauteng and North West. Ten individuals were interviewed, including a disaster management specialist, a curriculum specialists, emergency response officers, disaster lecturers and two student teachers.

As indicated in Chapter one, the aim of this study is to determine how the South African education system, in particular curriculum and classroom teaching, contribute to enhancing learners' resilience to disasters. While it was intended that each question should have its own dominant research method, during the application of data collection it became apparent that almost all data collection methods were cross-cutting. Each research method was linked to each sub-question of the study with almost all methods addressing specific elements of other questions not answered well by the specific method linked to the question.

The first sub-question which aimed to determine *what disasters are prevalent in South Africa,* and the second sub-question which looked at *the extent to which South African communities are vulnerable to such disasters*, were linked to a literature study but in the questionnaire the first question probed what educators know about the disasters in their area. During the interviews respondents were asked about the prevalence of disasters in their area.

The third question was linked to research sub-question two aimed at determining *how the South African national curriculum could enhance the teaching of hazards and disasters in schools.* The fourth question looked at *the extent to which indigenous knowledge and integrated teaching could enhance learners' awareness of hazards and disasters*. Even here, although the questionnaire was the main method to address the question, both interviews and document study played an important role in providing useful information.

The fifth sub-question aimed at determining in *what better ways the teaching of disasters can be fully integrated in South African Education* was linked to the third method of interview but as with the first two questions, the other two methods played an important role in providing answers to the third question.

3.3.2 Data collection through literature and document review

Policy documents such as the Disaster Management Act of 2002, website description of Disaster Management Centre activities, National Curriculum Statements guidelines, Curriculum 2005, national and international policy documents related to disasters and curriculum such as UNESCO's South African National Commission on Disaster Management Plan, the Hyogo Framework Action Plan 2005 – 2015 and International Strategy for Disaster Reduction (ISDR) were considered. Research journals and other publications, scientific and non-scientific, were used to gather data to address the sub-research question. The main purpose of using the document study was to gather data that would inform what disasters were prevalent and to what extent communities were vulnerable to such disasters.

3.3.3 The use of questionnaires as a data collection tool for this study

The second data collection method comprised questionnaires which were completed by 150 educators employed in schools situated in informal settlements from five provinces which included Gauteng, KwaZulu-Natal, Western Cape, North West and Eastern Cape. Initially permission was requested from education departments in all nine provinces in South Africa, hoping that the total number of the respondents would be 270 if 30 educators from each of the nine provinces completed the questionnaires. Unfortunately four provinces, the Free State, Limpopo, Mpumalanga and Northern Cape did not respond to the request for permission to conduct research even after persistent telephone calls to the offices. Five out of nine was a good response and especially since the three provinces, Gauteng, Western Cape and KwaZulu-Natal responded. An attempt was made that at least 30 respondents participated in each province by distributing many questionnaires in identified schools. In each province more than thirty

questionnaires were distributed in those schools that showed interest through the discussion with the principals.

Considering the busyness of educators and the perception that they might not be willing to complete long questionnaires that probe for much detail outside school operational times, the questionnaire was structured so that the educators could tick only 'Yes' or 'No'. Cohen et al. (2007:322) make it clear that the dichotomous questions are useful for they compel respondents to get off the fence on an issue and make it possible to code responses quickly. A section asking respondents to give comments was included at the end of the questionnaire for those educators willing to provide more explanation. According to Eaden, Mayberry and Mayberry (1999:399) the use of dichotomous questions (a yes/no answer) is associated with significant reproducibility and reliability. This is particularly so when collecting factual information about health. To be really effective it is best to use questionnaires that ask for boxes to be ticked or strength of agreement to statements to be indicated. This has the advantage that it is easier and faster for the recipient to complete and also allows direct comparability of answers. Eaden et al. (1999:400) maintain that a relatively short and non-contentious questionnaire, which includes a description of the purpose and benefits of the study is linked to the response rate that is more than 90 percent and that in practice, many respondents are put off by questionnaires greater than A4 in length. Romero and Han (2004:617) maintain that the proposed negation in yes/no questions contributes to the implications that the speaker believes or at least expects that the positive answer is correct. These authors argue that this type of questioning is useful when the intent of the speaker (researcher) is to ask the addressee (respondents) for conclusive evidence (positive) or any possible doubts (negative). In this study, for example, the literature review revealed that indigenous knowledge is essential to raise learners' awareness of hazards and disasters. The use of Yes/No questions therefore assisted in providing data that tell whether educators are positive about literature findings or have doubts. The interview here was used to give conclusive evidence on whether indigenous knowledge would enhance learners' awareness of hazards and disasters if included in classroom teaching.

In this respect, the limitations of using Yes/No questions in a PhD study are acknowledged; to address these limitations the study employed interviews with specialists with various expertise

on the phenomenon of disasters. Amaratunga et al. (2002:23) argue that triangulation is mostly used for the fact that its effectiveness rests on the premise that the weaknesses in each single method will be compensated by the counter-balancing strengths of another. It is therefore important to note that the use of questionnaires completed by 150 educators contributed to strengthening data collected through the literature review and interviews.

3.3.3.1 The reliability of data collected through the questionnaires in this study

The reliability of the questionnaire was tested through a pilot study in which five respondents were given the questionnaires to complete. Two were former educators, while three were currently teaching. The former educators were included for their knowledge of the research process, as one had just completed her doctoral degree while the other former educator was currently studying towards a PhD degree. The three other educators included two teaching Grade 7 and one teaching Grade 9. The initial questionnaire had 21 questions and 21 spaces for comments. Four of the pilot respondents complained that it was too long for educators, to complete, given their experience. On their advice, the questionnaire was shortened without losing the essence of the required data. After effecting changes the following categories were included:

- *A consent form which informs educators of their right to privacy and informs them that they provide information on a voluntary basis as well as informs them that their participation is confidential.*

Inclusion of this category was informed by the fact that respondents cannot be coerced into completing the questionnaires. Cohen et al. (2000:245) maintain that respondents might be strongly encouraged, but the decision whether to become involved and when to withdraw from the research is entirely theirs.

- *Demographic details such as the name of the school, area, gender and experience in terms of years.*

Demographic details help to provide variable information that could otherwise affect the research and help to caution the researcher to go back and collect more data to avoid biases. For example, if the questionnaires were completed by only males, it would be essential to go back and request females to complete them. In this case the respondents were asked to provide information regarding their age, gender, the name of school and the province. This information was probed because it was essential for the analysis of data.

- *Compulsory questions on knowledge of curriculum and its implementation as well as the modalities for teaching hazards and disasters.*

This category was informed by the literature study in constructing the questions. The questions were then reconstructed after a pilot study completed by five respondents. This section was important because data provided can determine whether the questions raised in the study were answered or not. More details on the questions asked in the questionnaire are explained in depth later in this chapter.

- *Optional section for educators' comments in order to provide additional information or to give more details on their choice of answers.*

In this category respondents had an opportunity to raise anything about the research questions or to add something that they would like to stress.

The researcher collected data from educators following guidelines given in the approval letters from the provincial departments of education. The questionnaires were structured so that the researcher had to explain to the respondents the purpose of the research and then ask for permission to collect data, duly explaining the rights of the respondent to refuse participation if she so wished. No coercion or promises were made to the respondents and they were informed that their confidentiality would be guaranteed.

The process was timed at not more that 20 minutes for each educator to respond. Negotiation was entered into with the relevant principals and educators for the suitable time to complete the

questionnaire without jeopardising the educators' duties and as prescribed in the letters of authorisation. The questions below formed the basis of data collection among sampled educators:

1. In your own view, is your area likely to be affected by natural or man-made disasters?
2. Should hazards and disasters be included in the National Curriculum Statements learning outcomes?
3. Is it necessary for learners to be taught about hazards and disasters in your school?
4. Have you ever included natural and man-made hazards and disasters in your learning area when you teach learners?
5. Have you given your learners an opportunity to observe a real-life or visual representation of hazards or disaster event?
6. Have you ever included any indigenous knowledge information on hazards and disasters in your teaching?
7. Have you ever taught learners how to identify potential hazards in their environment?
8. Have you ever teamed up with other educators to develop a learning programme for hazards and disasters?
9. Have you ever checked whether learners do discuss what they have learned about hazards and disasters with their families?
10. Have you ever taught your learners how to respond when faced with disastrous events?

3.3.3.2 Validity of phrasing the questions as depicted in the questionnaires

Question 1 was included in the questionnaire in response to the emphasis by the Hyogo Framework for Action 2005 – 2015 that stresses the importance of disaster risk reduction being underpinned by a more proactive approach of informing, motivating and involving people in all aspects of disaster risk reduction in their own local community. Other researchers as discussed in Chapter two emphasise disaster risk reduction strategies that are country and in particular area specific. For example, Pelling and Uitto (2001:52) maintain that examination of how best to cope with physical shocks and stress needs to focus on local contexts. The question was meant to address the first sub-question which is concerned with the identification of disasters common in South Africa. Almost all the questions that followed below were intended to provide data for the

second sub-question of the study which was concerned with the integration of hazards and disaster in the curriculum and classroom teaching.

The design of question 2, 3, 4, 5, 7 and 10 was motivated by the Hyogo Framework for Action 2005 – 2015 which points out that countries should promote the inclusion of disaster risk reduction knowledge in relevant sections of the curricula at all levels and the use of other formal and informal channels to reach youth and children with information (ISDR:2005:9). As indicated in Chapter two, Shaw et al. (2004:48) argue that school education is important in enhancing knowledge and perception of earthquake disaster and they are supported by Hosseine and Izadkhan (2006:650), Shiwaku et al. (2007:585) and Ozmen (2006:392). Moreover, the Disaster Risk Reduction Begins at School campaign was spreading the message that disaster reduction projects in the future could be improved by increasing the number of hours allocated to disaster preparedness in the regular school curriculum, and organising sensitisation and education presentations to be given by disaster management officials at schools (ISDR:2007:14)

Question 6 and 9 tested the use of traditional or indigenous knowledge as another way of raising awareness of learners. As discussed in Chapter two under the sub-section *The role of indigenous knowledge on learner awareness of hazards and response to disasters*, indigenous knowledge scholars such as Snively and Cosiglia (2000:17) maintain that many indigenous groups in diverse geographical areas from the Arctic to the Amazon have their own system of managing disasters and recognise the feasibility of using traditional ecological knowledge for contemporary problems. Snively and Corsiglia (2000:26) further argue that teachers need to probe and include indigenous and local knowledge of learners. Pelling and Uitto (2001:56) argue that because of modernisation of island cultures where indigenous knowledge and practices are most extensive, the capacity of a society to absorb disaster shocks is likely to decline. Gaillard (2007:539) proposes a framework that enhances the local consideration of the problems rather than limited industrialised solutions. Gupta and Sharma (2006:70) maintain that some native islanders survived the tsunami because they lived on higher ground or far from the coast due to their local or native knowledge. Agrawal (2004:5) argues that indigenous knowledge is disappearing due to the pressure of modernisation, such as the current perception of a school system based on Western ideologies. Agrawal (2004:6) promotes the multiple domain and types of knowledge

usage as long as it safeguards the interests of those who are disadvantaged. Stevenson (1996:284), in his support for inclusion of indigenous knowledge as another way of raising learner awareness of disasters, maintains that the participation of aboriginal people in environmental assessment is warranted because they have in-depth knowledge of their lands and communities. Other scholars propagating the inclusion of indigenous knowledge to enhance learners' awareness of hazards and disasters include Hellier et al. (1999) and Alexander (1997).

Question 8 was modelled on the use of integrated teaching to enhance learners' awareness of disasters as supported and reflected by scholars such as Carl (2005), Kirk and Macdonald (2001), MacDonald et al. (2002), Creese (2005), Fisher and Mcdonald (2004), Morton (1993) and Arredondo and Rucinsky (1997), Ranby and Potenza (1999), Loepp (1999), Venville, Wallace, Rennie and Malone (2001), Chambers (1995) and Gehrke (1998).

While these questionnaires required that respondents give a Yes/No answer, Cohen et al (2007:322) and Rosnow and Rosenthal (1996) maintain that it is a natural human tendency to agree with a statement rather than to disagree with it which might result in bias from respondents. In this study the bias was taken care of by distributing the question not only to Grade 7 educators, which would have resulted in only affirmative answers; other grade educators were covered as well. The questionnaire was open to be distributed to any educator within the school without necessarily restricting it to a specific grade. School principals and heads of departments were determinants of who participated in completing questionnaires following the guidelines provided by the researcher.

According to Cohen et al. (2000:128) validity could be achieved through careful sampling, appropriate instrumentation and appropriate statistical treatments. In this study, thirty respondents per province were selected and five provinces were selected. The literature study, it indicated that the Western Cape and Gauteng have the largest informal settlements in South Africa and these two provinces were targeted. However, to ensure that data collected are representative, permission was requested from all nine South African provinces. Only five responded positively.

As discussed in Chapter 1 the idea of this type of research was conceived from a social visit to Ivory Park informal settlement; the first research site for this study was Ivory Park informal settlement in Gauteng. In the Western Cape, Khayelitsha is one of the biggest informal settlements in the province located near Cape Town International Airport. The other three areas were chosen not because they were informal settlements but because of the vulnerability embedded in them. Bizana in the Eastern Cape is a rural settlement with schools located in mountainous areas and their greatest challenges are floods and storms. Isipingo in Kwa-Zulu Natal is a formal settlement area but like informal settlements it has a problem of overcrowding and is vulnerable to disasters such as floods, fires and health related risks. Brits was selected because of its being a combination of informal settlement, farm schools and formal settlement schools. In total, five areas were chosen as research sites, the first two depict informal settlement vulnerabilities while the other three depict combinations of different settlements.

Thirty schools were targeted for data collection in each of the five provinces, bearing in mind that in one school data could be collected from a maximum of five educators, which drastically reduced the number of schools to fewer than thirty per province. The total number of schools that participated in the study was 47 broken down to eight in the Western Cape, ten in KwaZulu-Natal, eight in North West, nine in Gauteng and 12 in the Eastern Cape.

Ivory Park in Gauteng was the first area to distribute questionnaires, which proved to be challenging. During the first day only three schools were covered because questionnaires were distributed to those schools and the principals promised that they would give them to teachers during their lunch break. In three schools the questionnaires were not distributed and I was promised that if I came back the next day, the respective educators would have completed the questionnaires. On the next day, two of the three principals had lost the questionnaires. I had to distribute them again but requested the principals to distribute to the heads of departments to which they agreed. The experience in Gauteng taught me that when I got to a school, I asked for permission from the principal and then asked to leave the questionnaires with the heads of department, which proved to be effective.

It took one week to distribute and collect questionnaires in the Western Cape, mainly focusing on Khayelitsha. The process was that a day was reserved for asking permission from principals and leaving five questionnaires per school. The first six schools nearest to one another were targeted and additional schools were added on the next four days, depending on the number of questionnaires completed until the required number of questionnaires was reached.

North West Province was difficult because the research covered not just one place and schools were isolated. Different locations which included farm schools, informal settlements and formal settlement schools were consulted. Lessons learned during data collection proved to be effective and helpful. KwaZulu-Natal and the Eastern Cape were easier because they were the last provinces and data were collected in seven days simultaneously, mainly because of the proximity of the two areas, Bizana and Isipingo. The first day was used to distribute questionnaires to eight schools in Isipingo and these were collected the next day. Where questionnaires had not been completed as requested an appointment was made for the following week Monday. Wednesday was used to distribute questionnaires to twelve schools in Bizana to be collected on Thursday and Friday. On Monday the remaining questionnaires were collected in Isipingo.

While data collected in 47 schools from 150 educators cannot be representative of the views of educators within the country, the data collection for this sample was essential to provide insight into how educators from different provinces think about teaching about disasters. Data provided by this population while informing about issues related to disasters nevertheless provided essential information that was used to inform the interview questions.

3.3.4 Data collection through interviews

During the research proposal phase it was planned that the third research method would be focus group interviews where relevant respondents were invited on the same day. This method was expected to save costs and time for the interview to be completed within the agreed time-frame. However, during the implementation phase it became extremely difficult to have all experts in the same room on the same date and at the same time. As a result individual interviews were then

considered as the possible method that could yield the same results as the focus group, even though it cost time.

The main reason for choosing interviews as a third method was that they have the potential to enable the gathering of data that would mainly address the third question as well as of providing data for both sub-question one and two. In essence the interviews served as the core of the research method and were used to gather data that could not be collected through the literature study and questionnaires. According to Cohen et al. (2000:268) interviews can be used in research to follow up unexpected results and go deeper into some questions raised.

The sampling of disaster management experts was guided by the provision in the South African disaster management regulation that hazards and disaster education should be part of school teaching. For the purpose of this study three disaster management experts were sampled, a senior manager from the National Disaster Management Centre, a lecturer who trained emergency response officers from North West College and was part of the rescue team mission that went to assist in Haiti and a senior emergency officer who worked for Enviroserve, responsible for accidental disasters that could harm the environment, animals and human beings. For an education background five curriculum coordinators were sampled who were involved not only in monitoring and evaluating educators' compliance with the national curriculum but provided advice on the implementation thereof. These curriculum coordinators consisted of a national curriculum coordinator from head office, a curriculum director from Eastern Cape Provincial Education, provincial curriculum coordinators from Gauteng, Northern Cape and Mpumalanga. Two university lecturers were sampled because of their role in preparing educators and disaster education facilitators and for their research expertise through producing scientific publications used as part of the literature. The lecturers come from Wits University and the University of the Free State and had research experience in hazards and disasters.

Interview questions were developed in line with the conceptual framework discussed in Chapter two. The first question was based on vulnerabilities and the prevalence of disasters and the questions were adapted from researchers such as Shaluf (2007), Mgquba and Vogel (2004), Reid and Vogel (2006), Reich (2006), Landau and Saul (2004), Napier and Rubin (2002), Pelling and

Uitto (2001), Forthergill and Peek (2004), Paton and Johnston (2001) and Bull-Kamanga et al. (2003). Researchers supporting education as a way of raising awareness in learners which covers the third and fourth guidelines below include Shaw et al. (2004), Shiwaku et al. (2007), Hosseini and Izadkhah (2006), Ozmen (2006) and King (2000). The fifth guideline on indigenous knowledge was adapted from the viewpoints of researchers such as Snively and Cosiglia (2000), Gaillard (2007) Hellier et al. (1999), Briggs (2005), Stevenson (1996), Gupta and Sharma (2006), Rautela (2005) and Agrawal (2004).

The following guidelines ensured that the interviews were focused and yielded desired results. The participants shared their general perspective regarding:

- what hazards and disasters which might affect school learners are common in South Africa;
- the level at which learners should be taught about hazards and disasters;
- the manner in which the national school curriculum should address the teaching of hazards and disasters;
- the manner in which the teaching of hazards and disasters in the classroom should be done;
- the inclusion of indigenous (traditional) knowledge during teaching of hazards and disasters;
- the integrated learning approach whereby educators from different learning areas team-up to raise learners' awareness, knowledge, understanding and application in dealing with hazards and disasters.

These interview questions adapted from the literature as discussed above are important in this study because they helped to inform whether education contributes to enhancing learner awareness of hazards and disasters. They even added more data in support of the data collected through questionnaires.

Although reliability and validity apply to quantitative research techniques, in this study all interview respondents were requested to sign a consent form to declare that they were participating of their own free will. In some instances the identity of some of the participants

would be hard to conceal. Examples are those that published widely, like a professor form Wits University and a team leader of the rescue mission to Haiti. Another method to improve the trustworthiness of interview data was through the recording of the interview proceedings and transcribing those proceedings afterwards. A document trail was used as another method to improve the trustworthiness of the study where interview records would be safely stored for the verification process in future.

The following process was followed for data collection through interviews.

1. Steps before conducting the interview:
    - Develop the interview guidelines
    - Discuss with research leader/supervisor
    - Pilot the interview guidelines
    - Sample participants
    - Request permission from sampled participants
    - Ask participants to sign consent form

2. Steps during the interview
    - Thank respondents for availing themselves for the interview
    - Introduce myself and the research
    - Request permission to record the proceedings
    - Ask respondents questions according to the interview guidelines
    - Give respondents opportunities to ask questions or make comments
    - Thank the respondents

3. Steps after the interview
    - Listen to the interview records and transcribe them
    - Reread the transcripts to determine if they make sense
    - Analyse the transcript using categories
    - Record the findings using descriptive analysis

- Save the record and write it to a CD for safe keeping

3.4 The research sample that applies to this investigation

3.4.1 Research sample for questionnaires

It has been indicated in Chapter one that this study focuses on the informal settlement context and the reason given was that hazards and disasters mostly affect the poor most of whom in South Africa reside within informal settlements. Informal settlements are a recipe for disaster because of the way the areas are selected. In this study educators who worked at schools located in informal settlement such as Ivory Park, Khayelitsha, Brits informal settlements, Bizana and Isipingo, were invited to complete questionnaires while relevant specialists consisting of five curriculum specialists, three representatives from Disaster Management institutions and two lecturers from institutions of higher learning were also invited to participate. Permission was obtained from the provincial departments of education to allow educators to participate in the research.

A convenience and purposive sampling technique was used for sampling educators because they were working in schools that were located in the surroundings of informal settlements. This form of sampling is relevant because it enables the researcher to ask for permission from the principal and the available educators were asked to respond to the questionnaires. The first priority was given to Grade 7 Social Science educators and the invitation was then extended to any educator available. Letters of request were sent to all nine provincial education departments and permission was secured from five provinces, KwaZulu-Natal, the Western Cape, the Eastern Cape, North West Province and Gauteng. The Google search engine was used to ascertain which areas had in the past experienced disasters and numerous informal settlements were identified. Among them were Khayelitsha and Ivory Park. These two settlements were then selected because of easy access and familiarity with the environment. Bizana and Brits settlements were selected because of being on the boundaries of the selected provinces. Isipingo was selected because of its vulnerability, coupled with an ease of access from the Durban International Airport.

3.4.2. Research sampling for interview participants

In this study ten interview participants were sampled using convenience and purposeful sampling. The rationale for using purposeful sampling was that the participants were the most likely to provide relevant data to address the research problem, and their availability and willingness to participate made the sampling convenient. The lecturers and curriculum and disaster management specialists interviewed were selected because of their response to the request and their availability. Interviews were conducted with a professor of Geography from Wits University, a lecturer in Disaster Management from the University of the Free State, senior manager within the National Disaster Management Centre, five curriculum specialists one from the National Department of Basic Education, the Eastern Cape, Gauteng, Mpumalanga and the Northern Cape provincial departments of educations, a senior emergency officer from Enviroserve and a lecturer at North West Emergency Response Training Institute.

3.5 Data analysis approach applied in this study

Triangulation was used during data analysis to determine whether the data collected through document study, questionnaires and interviews provided the same results, provided different results or resulted in new data as informed by Creswell et al. (2004:11), who argue that triangulation of mixed method data is more difficult to implement than other analysis methods because of the need to reconcile and bring together quantitative and qualitative data to better understand the problem. Caracelli and Greene (1993:196) maintain that triangulation seeks convergence, corroboration and correspondence of results across different method types. The concept of triangulation was first used as a military strategy that uses multiple reference points to locate an object's exact position because multiple viewpoints allow for greater accuracy as recorded in Jick (1979:602). Amaratunga et al. (2002:23) maintain that the use of triangulation should be motivated by the assumption that its effectiveness rests on the premise that the weaknesses in each single method would be compensated by the counter-balancing strengths of another.

3.5.1 Data analysis of the responses retrieved from the questionnaires

Cohen (2000) maintains that once data have been collected, the researcher's task is to reduce the mass of data obtained to a form suitable for analysis; data reduction generally consists of coding either by hand if the survey is small or by computers when numbers are large. The hand option was used where the educators' responses were captured into an Excel spreadsheet. According to Cohen et al. (2000) statistical processing consists of nominal, ordinal, interval or ratios. The nominal and ordinal are often derived from questionnaires and surveys while the interval and ratios are derived from experiments and tests. As indicated above, this study used questionnaires, the nominal and ordinal were the best statistical processing approach to analyse data. Quantitative data analysis in this study concentrated on the mode and frequencies of scores by educators. The task was to determine which questionnaire items had been scored the highest or the lowest and what were the frequencies of the answered questionnaire. In each of the questionnaire items, the respondents were expected to tick Yes/No and then provide an explanation afterwards. The information was captured on an Excel table with pre-developed formulas and the frequency of respondents' scores was analysed and decision made. The study therefore relied heavily on descriptive and frequency analysis.

The Excel table indicated how many respondents answered particular questions and how many said Yes/No per region, gender, province and their experience as educators. A chart was used to provide a visual representation of data for each category. The analysis informed the perceptions of educators on teaching about hazards and disasters in schools and whether there was a need for improvement. Some questions had been repeated just to determine whether respondents did not just tick without reading the questions.

3.5.2 Data analysis of interviews responses and document study

According to Creswell (2009) qualitative data analysis is an ongoing process involving continual reflections about the data, asking analytic questions and writing memoranda throughout the study. This type of analysis involves collecting open-ended data, analysing for themes or perspectives and reporting the themes. Cohen et al. (2005) maintain that qualitative data analysis

involves organising, accounting for and explaining the data to make sense of participants' definition of situations, noticing patterns, themes, categories and regularities. Interviews, document study and literature reviews fall within the ambit of qualitative data analysis. During the literature study, themes were identified which related to questions being addressed in the study. These themes were used as questions posed to the participants during interviews and their responses were analysed to determine whether the themes were covered or not. Logical analysis was employed through comparing data from literature study as recorded in Chapter two.

Creswell et al (2004) argue that triangulation is more difficult to implement than other analysis methods because of the need to reconcile and bring together quantitative and qualitative data to better understand the problem. In this study triangulation is applied to check whether data collected from educators, curriculum and disaster specialist as well as from literature and policy documents yield the same results, have noticeable patterns, produces new insights or agree with each other. A table is used in this study to reflect the insight emerging from literature, questionnaires and interview data collection.

3.5.2.1 Coding of the interview transcripts to enable analysis of interview data

In section 3.3.4 above generic steps for the interview process were discussed and it was pointed out that the interview proceedings would be recorded and transcribed to enable capturing all ideas flowing from participants. To ensure that data collected were reported correctly, the following categorisation strategy was used:

- The Shaluf (2007) disaster tree was used as a guideline for disasters that could be affecting the country. From the transcripts any reference to disasters appearing on the disaster tree and mentioned by the interview participants was colour-coded with a pink marker (represented as 1 in this report). Those disasters not listed on the disaster trees but recorded by other scholars were colour-coded with a powder blue marker (represented as 2) while those not listed in any literature were colour-coded with a light green marker (represented as 3).

- In all instances the respondents were classified as curriculum specialists, disaster specialists or disaster lectures.
- Regarding the vulnerability of communities the guidelines for coding were derived from literature sources and the following categorisation was used:
    - All concepts mentioned in the vulnerability section in Chapter two such as poverty, informal settlements, buildings and structural vulnerability, shacks and residence on river banks were colour-coded with pink, while new items relating to vulnerability were colour-coded in light green.
- All participants who agreed on the inclusion of hazards and disasters in the national curriculum were colour-coded with pink and those that were not sure were colour coded with powder a blue marker and those that indicated that it should not be integrated were coded with a light green marker. A follow-up question was on what level should the integration of hazards and disasters into national curriculum take place and those that wanted it to be as it was now were coded with light green and those that indicated a specific grade were coded with pink, while those who indicated that it should feature in more than one grade were coded powder blue.
- Those that indicated that indigenous knowledge and integrated teaching should be used by teachers were coded in pink; those who were not in favour of the two concepts to be part of teaching were coded in powder blue and finally those who gave additional information on the issue were coded in light green.
- Those who mentioned strategies identified in literature were colour-coded pink, those who suggested new strategies were coded powder blue while those who did not have any strategies were coded in light green.

As a way of summary the table below depicts themes and categories identified from literature study and discussed in depth in Chapter two. The themes include concepts such as vulnerability, curriculum, instructional design, indigenous knowledge and integrated teaching. During data collection especially, the emphasis was on how participants viewed the contribution of these themes to learners' awareness of hazards and disasters. The findings should reflect a close scrutiny of these themes and recommendations ought to show a link to the themes

Table 3.2: The table depicting the link between the research questions, research methods and data collection sources

Main Research Question	Sub Research Questions	Research Method	Research Technique	Research Sample	Data Analysis
How does the South African education system, in particular curriculum and instructional design, contribute to enhancing learners' awareness of hazards and resilience to disasters?	1. What disasters are prevalent in South Africa?	Qualitative	Literature, document study and interviews	Literature on hazards and disaster, 3 disaster specialists, 5 curriculum coordinators and 2 disaster lecturers.	Logical Analysis
	2. To what extent are South African communities vulnerable to such disasters?	Qualitative	Literature, document study and interviews	Literature on hazards and disaster and 3 disaster experts, 5 curriculum experts and 2 disaster literatures	Logical Analysis
	3. How does the South African national curriculum cater for the teaching of hazards and disasters?	Qualitative-Quantitative	Literature, document study, interviews and questionnaires	literature on hazards and disaster and 3 disaster experts, 5 curriculum experts and 2 disaster lectures and 150 educators	Logical analysis and descriptive/frequency Analysis
	4. To what extent would indigenous knowledge and integrated teaching enhance learners' awareness of hazards and resilience to disaster?	Quantitative – Qualitative	questionnaires and interviews	Literature on hazards and disaster and 3 disaster experts, 5 curriculum experts and 2 disaster lectures and 150 educators	Logical analysis and descriptive/frequency analysis
	5. What other learning strategies could enhance learners' awareness of hazards and resilience to disasters?	Qualitative	interviews	3 disaster experts, 5 curriculum experts and 2 disaster lecturers	Logical analysis

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3.6 Measures to address validity and reliability of the study

Healy and Perry (2000) have developed criteria that can be used to determine the validity and reliability of research within the four paradigms of research. Such criteria include ontology of realism, contingent validity, triangulation, methodological trustworthiness, analytic generalisation and construct validity.

According to Golafshani (2003:599), reliability is the consistency of measurement, or the degree to which an instrument measures the same way each time it is used under the same conditions with the same subjects. To ensure that the research is reliable, triangulation was used to determine points of similarities and differences from data collected through a literature study, questionnaires and interviews. Validity is defined as the strength of the research conclusion, inferences and propositions and it could either be a construct, content, internal, external or instrument validity.

Leedy (1997) maintains that strategies commonly employed to achieve trustworthiness in qualitative research include triangulation, member checking, chain of evidence, outlier analysis, pattern matching and representative checking. In this study, triangulation and member checking were used to improve the trustworthiness of the data collection. To ensure that the data collected were valid and reliable various measures were employed such as the following:

- Submitting an ethical statement for approval by the University of Pretoria ethics committee.
- Asking for permission from the provincial department of education and school authorities.
- Asking respondents consent for their participation.
- Recording the participants' responses through a recording device and transcribing them.

To ensure that data collected from respondents were reliable, the questionnaire was piloted to five educators and their comments were solicited which resulted in drafting the final questionnaires. Triangulation was used to check consistency in the findings. The interview participants were requested to check whether their views had been represented appropriately.

3.7. Research limitations for the study

The purpose of this study was to determine how education, in particular, curriculum and instructional design contributes to learners' awareness of hazards and resilience to disasters. The topic is essential as disasters are currently affecting many South Africans. However it is important to consider that its wide scope had necessitated that it be narrowed down, which resulted in sacrificing some key elements such as data collection from learners and also focusing on the contribution that community training could make to disaster risk reduction. For the problem to be addressed in its entirety, more data should be gathered from educators, curriculum experts, disaster education experts, learners, recent disaster sites, disaster victims and the community in general. This study however, focused only on gathering data from educators and a few disaster and curriculum specialists given the limited time and resources linked to PhD studies.

There is a methodological limitation as well: this study would have been enhanced by sampling a large population of educators from all learning areas to complete questionnaires but given limited capacity of human resources, time and finance for this study, the data collection was limited to 150 educators completing questionnaires. Also if educators were interviewed, the findings in this study could have been enhanced. Rather than focusing on all schools in South Africa, the study sampled educators from schools located in selected informal settlements, which makes it difficult to generalise.

According to Ary et al. (2002) data analysis is a process whereby researchers systematically search and arrange the data in order to increase their understanding of the data and to enable them to present what they have learned from others. Ary et al. (2002) further suggest that to simplify the complexity of data analysis, it is best to break the data down into manageable steps: organising data, summarising data and interpreting data.

The data were analysed using a two-stage analysis approach whereby data collected through three methods (document study, questionnaires and interviews) were analysed first individually; the second stage was to analyse the combined results through triangulation to determine

corroboration, similarities or differences. The first analysis focused on data collected through document and literature study. The second analysis considered the demographic details of educators in the first section of the questionnaires and the main questions and comments at the end of the questionnaire.

The collected data provided information on the perspective of educators on hazards, disasters and National Curriculum Statements. The third analysis considered data collected from interview participants consisting of curriculum specialists, disaster management specialists and hazards and disaster lecturers.

Making sure that educators provide an honest opinion when completing the questionnaires is another area of limitation of this study. Moreover, it was not possible for the researcher to sit with all educators while they completed questionnaires and a follow-up was not possible because of the confidentiality clause which encouraged educators not to provide their names. However, the researcher made sure that questions were asked to those educators who agreed to complete the questionnaire in the researcher's presence.

3.8 Conclusion

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The research design made it easier for the researcher to collect required data without compromising their reliability and validity. The choice of multiple methods of research was the best decision because the questionnaire responses provided the basis for posing questions during the interviews. The richness of such data collected at schools located in informal settlements from the five sampled provinces, the Western Cape, KwaZulu-Natal, North West Province, the Eastern Cape and Gauteng as well as from disaster and curriculum experts contributed to understanding the depth of the problem under investigation. The next chapter will demonstrate the richness of such data collected. The researcher managed to collect relevant data from sampled individuals without compromising the validity, reliability or the trustworthiness of data collection.

Chapter 4

Analysis and discussion of the results of the investigation

4.1 Introduction

In Chapter four data collected through questionnaires and interviews are displayed, analysed and discussed in depth to determine whether they addressed the main research question posed in Chapter one:

> *How does education, in particular curriculum and instructional design, contribute to learners' awareness of hazards and resilience to disasters?*

The chapter determines whether the provisions as stipulated by the National Management Disaster Framework are being implemented as stated by the NDMC (2005:79). Disaster risk reduction education must be integrated in primary and secondary school curricula. Schools should be regarded as focal points for raising awareness about disaster risk management and disaster risk reduction. The risk reduction component of disaster risk management education should be linked to broader education programmes relating to development and the environment.

The chapter also reports on the understanding and implementability of principles discussed in the NCS (2003:3 by the Department of Education). The principle of integration of learning within and across subjects and fields of learning is crucial for achieving applied competence and to promote learning of theory, practice and reflection. The NCS (2003:4) further discusses the principle of valuing indigenous knowledge as essential to enhance learners' understanding of the world demands and that it should be infused into subject fields as such.

To ensure that there is logic and systematic flow of addressing this question, data presentation in this chapter was done using the order of the sub-questions as listed in Chapter one. For example the first sub-question intended to determine what disasters are prevalent in South Africa. Data collected through questionnaires were displayed, analysed and discussed to determine whether

evidence was provided to address the question and a conclusion was given. Data collected through interviews followed the same format and the data set collected through questionnaires and interviews was triangulated with findings from literature to determine if sub-question one had been addressed. This format was followed right through to sub-question five and the final section looks at whether the collected data provided evidence to address the main research question. Data findings from the literature review, questionnaires and interviews were analysed using descriptive analysis techniques and triangulation to determine whether education contributes to learners' awareness of hazards and disasters.

4.2 An analysis of data collected to address sub-question 1: *What disasters are prevalent in South Africa?*

The first sub-question intended to determine what disasters are prevalent in South Africa. This question was important because knowing the types of disaster that afflict the country would enable curriculum developers, educators to develop interventions that suit the target. Questionnaire respondents and interview participants responses are displayed in this section and compared to what scholars and policy documents say about the prevalence of disasters in South Africa.

4.2.1 An analysis of data collected through literature and policy documents

In Chapter two Shaluf's (2007) disaster tree framework was discussed as a starting point for disasters affecting the global community. Shaluf (2007) divides his framework into three broad categories of disasters: natural, human-induced and hybrid. According to Shaluf (2007), the first broad category consists of the phenomena beneath the earth's surface such as earthquakes, tsunamis and volcanic eruptions; the second sub-category refers to phenomena at the earth's surface such as landslides and avalanches. The third sub-category consists of meteorological/hydrological phenomena such as windstorms, tornadoes, hailstorms, sea surges, floods and droughts. The last sub-category consists of biological phenomena such as infestation characterised by locust swarms, mealy bugs and epidemics characterised by cholera, dengue fever, Ebola, measles, malaria, meningitis, yellow fever, AIDS, SARS, Avian Flu, etc.

The second category of human-induced disasters is divided into two sub-categories; socio-technical disasters and warfare. The socio-economic as the first sub-category is divided into disasters such as fire, leakage, toxic release, structure collapse, physical assets, explosions induced by ammunition, transportation disasters from land, sea and air, stadia and public places failure as well as production failure. Warfare as the second category of human-made disasters is divided into international and national conflict. International conflict refers to conventional war (war between countries, siege and blockade) and non-conventional war (nuclear, civil war, civil strikes, civil disorder, bomb threats and terrorist attacks). The third category refers to hybrid disasters such as floods ravaging communities built in flood plains, clearing of extensive jungle resulting in landslides and locating of residential areas and factories in vulnerable sites like avalanche areas.

The International Council for Science (ICSU) panel on natural and human-induced hazards and disasters in sub-Saharan Africa developed a science plan (2007:4) in which they recorded that Africa is an area prone to a wide variety of natural and human-induced disasters such as floods, hurricanes, earthquakes, tsunamis, droughts, wildfires, pest plagues, and air and water pollution.

The National Disaster Management Framework (2005:2) recognises a diversity of risks and disasters that occur in southern Africa, and gives priority to national developmental measures that reduce the vulnerability of disaster-prone areas, communities and households. Also, in keeping with international best practice, the NDMF places explicit emphasis on the disaster risk reduction concepts of prevention and mitigation as the core principles to guide disaster risk management in South Africa. According to the White Paper on Disaster Management published by the Department of Provincial Affairs and Constitutional Development (1999:21), South Africa like many countries in the world, is at risk from a wide range of natural, technological and environmental hazards that can lead to disasters such as droughts, floods, major fires, mining disasters, tornadoes, major oil spills and even earthquakes.

Reid and Vogel (2006:199/200) identify HIV/AIDS, floods, fires, drought and other waterborne disease while Mgquba and Vogel (2002:31) identify HIV/AIDS and floods as disaster challenge

for South Africa. Frost-Killan (2008:28) identify hazards such as human-induced earthquakes in mining areas resulting in sinkholes, landslides, flooding and coastal erosions. Linked to these is pollution of water with mining acids that is currently being reported in the South African media. Meiklejohn (2005:33) reported that hurricanes in the form of tropical cyclones affect the northern parts of the South African coastline. Meiklejohn and Sumner (2005:10) maintain that although South Africa would not experience as much devastation from tsunamis owing to its steep coast, low-lying areas of northern KwaZulu-Natal and the southern part of the Western Cape are vulnerable to tsunamis. Bradshaw (2003), Mayosi et al (2009), Wojcicki and Malala (2001), Bachmann and Booysen (2003), Macdonald and Schatz (2006), Susser and Stein (2000), Martin (2005) and Martin and Williamson (2004) identify epidemics such as HIV/AIDS, tuberculosis, cardiovascular disease as challenges for South Africa, which could result in disasters.

The next section will determine whether respondents and participants were aware of disasters and to determine whether they have identified any hazards or disaster that are different from those listed from literature and policy documents. The focus will be to check whether respondents and participants were aware of what was happening in their environment.

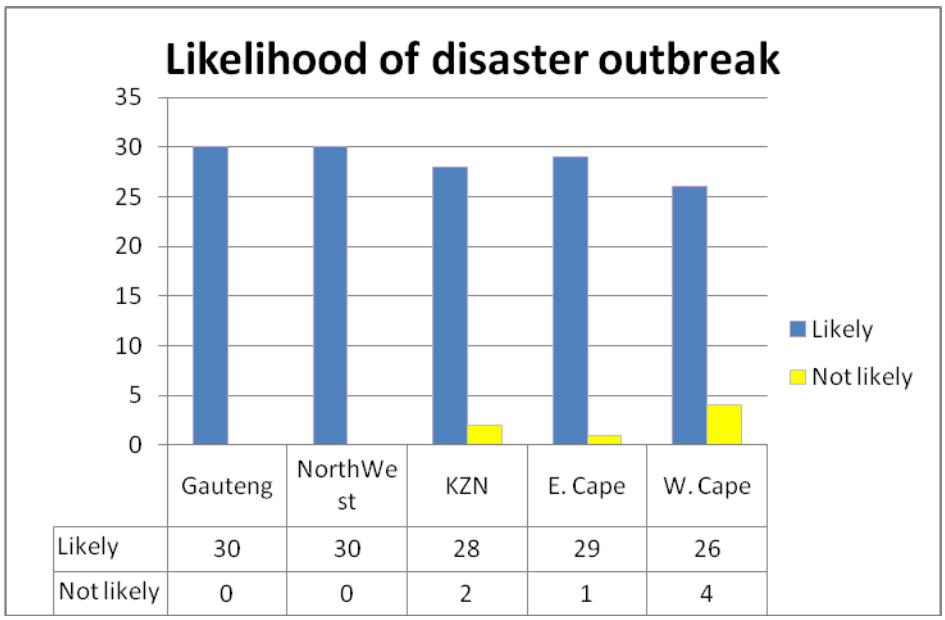
4.2.2 Questionnaire response in relation to the prevalence of disasters in South Africa

Data for this sub-question were collected through a questionnaire distributed to 150 educators located in informal settlement schools. The educators were asked whether their area was likely to be affected by hazards. The intention of this question was to determine whether educators were aware of hazards and disasters in their area and whether South Africa has a prevalence of hazards and disasters. The chart below indicates the responses per provinces and displays the information in percentages. Asking this question was informed by the assumption that if educators were aware of disasters that have affected the community in the past and were aware of hazards that were prevalent in the community, then they were likely to teach learners how to respond to disasters and hazards. This assumption was informed by Paton's model of preparedness recorded in Paton (2003 & 2007), Paton and Johnson (2001) and McIvor and Paton (2007) which places critical awareness as the centre of preparedness. Paton (2003) defines critical awareness as an

extent to which people think and talk about specific sources of adversity or hazards within their environment. Also the assumption relates well to the Shiwaku et al. (2007) education framework reported in p. 46/47 which used Rohrman's awareness model which states that awareness promotes action for disaster reduction in the community.

4.2.2.1 Chart display of educator responses on the likelihood of their area being affected by disasters

The responses of educators from Gauteng and North West Province reveal that respondents are completely aware that their area could be affected by disasters while in the Eastern Cape only one person thought that the area was not likely to be affected by disasters. In KwaZulu-Natal, two respondents thought that their area was not likely to be hit by disasters while in the Western Cape four educators thought that their area is not likely to be affected. The response to question 1 reveals that 143 out of 150 were in agreement that their province was likely to be affected by disasters while only seven did not think so. In terms of percentages, 95.3 percent of educators were aware that disaster could strike. However, the researcher is aware of the caution that needs to be taken when converting small raw scores into percentage. Since the data were collected from only five provinces out of nine, it is important to note that it is not representative of the entire country as four provinces did not participate in the study. However, since the response was from 55.5 percent of the provinces, the result has some value and should be considered as such. Furthermore, given that only 150 educators participated in the study out of a large population of educators in South Africa, it cannot be concluded that 95.3 percent of educators in South Africa believe that the country could be hit by disasters. Nevertheless, the data indicate that out of a population of 150 respondents, the majority agree that South Africa is likely to be affected by disasters. Since the aim of the sub-question was to determine what disasters are prevalent, the questionnaire provides educators' perspectives.



	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Likely	30	30	28	29	26
Not likely	0	0	2	1	4

Figure 4.1: Chart display of educator responses on the likelihood of their area being affected by disasters

In terms of the research problem the educators' responses indicate a high level of awareness that their areas could be affected by disasters. These results were expected as data was collected from schools located in informal settlement. What is important to note though is how much the results tie in with Figure 2.3 by Napier and Rubin (2002:5) as depicted in p30. Figure 4.1 depicts that there were educators in Western Cape and KwaZulu-Natal who thought that they would not be affected by hazards and disasters. In Figure 2.3, Napier and Rubin (2002) depicted that Cape Town has less informal settlement or what he calls backyard housing while in Durban there were no backyard settlements when their study was conducted. Gauteng educators' response shows that they believed that they were likely to be affected by disasters, and links well with Napier and Rubin's Figure 2.3 which showed a high number of informal settlements (backyard) in Pretoria and Johannesburg. The significance of educators' responses depicted in Figure 4.1 is the level of awareness within the schools thereby supporting that there is awareness within education of the need to teach learners. The results here are also consistent with the findings recorded by Ozmen (2006:391) where he found that after the 1999 earthquake in Turkey, learners gained much awareness of disasters and became prepared. This supports the idea that because these educators work within an informal settlement vulnerable to disasters they are more aware.

4.2.2.2 Educators' general comments related to the prevalence of hazards and disasters in South Africa

Although the questionnaire requested respondents to answer by selecting either Yes/No, they were further asked to make additional comments at the end of the closed-ended questions that relate to the research sub-question 1. Fifteen respondents gave additional comments related to sub-question 1 with six respondents from the Western Cape, five from the Eastern Cape, two from Gauteng, one from KZN and one from North West Province.

A respondent (R1) from North West commented that:

> *Our school is situated in an underdeveloped area consisting of narrow roads, houses get burned by fires and floods are problematic in the area.*

A respondent (R2) from the Eastern Cape commented that:

> *Soil has eroded at the river banks affecting the classrooms which were built in mud during the rainy season and cyclone and earthquakes can affect the country anytime.*

Other hazards identified by this respondent included poisonous plants and huge trees that fall during storms.

Another respondent (R3) from the Eastern Cape commented that:

> *I teach learners about road accident, floods, fire, heavy rains, wind, storms, tornadoes and droughts.*

A respondent commented that:

> *The questionnaire has highlighted the importance of an educated and intelligent response to the circumstances of man-made disasters vis-a-vis a house burning or a road accident.*

A respondent (R4) from the Western Cape commented that:

> *Potential hazards I taught them are about medical waste dumped in nearby areas where needles are often used by them to inject one another which might have been used on people with serious infection diseases, playing on wetland (Bloudam) or swimming there.*

Another respondent (R5) from the Western Cape commented that:

> *There's a need to teach our communities through our learners about mechanisms to protect them against man-made disasters such as shack fires.*

Other respondents from the Western Cape identified floods, veld fires, heavy rains as disasters prevalent in their area while Gauteng respondents added road accidents to fires and floods as the main hazards and disasters prevalent in their area as indicated by a comment by a respondent (R6) that:

> *Fire department did training for learners in 2008 about how to escape fire and traffic safety department as well trained educators and learners about safety in the road.*

Although the data provide evidence that educators in South Africa are aware of hazards that affect their communities, it should be noted that they were not asked directly, which makes the data more important. What is evident strongly from these comments is that they provide relevant evidence that some educators are not only aware of disasters but they teach learners about things that affect their communities, like the comments about medical waste, mud houses and road and fire safety. The educators comments reiterate the points discussed above, that the question has contributed by elucidating the high level of awareness detected from educators' response.

4.2.3 Interview responses in relation to the prevalence of disasters in South Africa

Individual interviews are regarded as essential in this study as the main data source. As discussed in Chapter three the respondents were coded as first, second up to the tenth with P1 to P10 referencing used. The first participant (P1), a senior manager from the National Disaster Management Centre maintained that a distinction should be made between hazards and disasters. Hazards are those incidences with potential to result in disasters while disasters are characterised

by loss of life and property. The most prevalent hazards in South Africa are floods, storms, veld fires, lightning, sinkholes and social conflicts such as those caused by xenophobia.

The same principle was supported by the second participant (P2), a lecturer from Wits University who distinguished between biophysical phenomena that include floods, droughts, storms, fires, cyclones and heat waves and socio economic disasters such as HIV/AIDS, xenophobic attacks as well as other chronic disasters. Much of what the third respondent had to say was aligned with many of the comments already reported in the previous paragraph. The third participant (P3), a lecturer from North West Emergency Response College identified hazards such as droughts, fires, floods, industrial explosion and chemical spillages as affecting North West Province and South Africa at large. P3 also identified some mine related disasters where mineworkers in the Rustenburg area and adjacent areas are continuously affected.

The fourth participant (P4), a curriculum coordinator from Gauteng, maintained that Gauteng experienced disasters such as floods, shack fires, dolomite; sinkholes, and in some cases communities experience extreme cold weather and transportation accidents, while the fifth participant (P5), a director in the curriculum unit in the Eastern Cape confirmed that the province experienced disasters that range from floods, and storms to fires. It is obvious that the Eastern Cape does not hold similar hazard threats as does Gauteng province, mainly because it has many more rural settlements as opposed to Gauteng, which has many informal settlements.

Both participants (P6). national curriculum coordinator and (P7), a provincial curriculum coordinator, from Northern Cape, were of opinion that South Africa was having a serious problem with floods, droughts and fires in areas such as the Northern Cape. These concerns were reiterated by the eighth participant (P8), a lecturer for disaster management from the University of the Free State, who argued that South Africa was experiencing hazards such as droughts, floods, veld fires, shack fires and added some more disasters such as rift-valley fever, foot and mouth disease and problems with water quality. He stressed HIV/AIDS as another critical hazard that needed attention.

Participant (P9), a senior manager from EnviroServe who previously worked for Ekurhuleni emergency services, added new value to the discussion by exposing additional hazards such as spillages by rail and road tankers and vehicle and public transport accidents. Possible risks caused by floods and fires were also highlighted by the same respondent.

The last respondent (P10) a curriculum coordinator, maintained that Mpumalanga was experiencing hazards such as floods, droughts and industrial accidents such as those that occurred in a SASOL plant situated in Mpumalanga (pipe bursts and car accidents caused by company tankers). P10 also mentioned that when you drive on the N4 between Middleburg and Emalahleni there was another hazard of fog in the morning making it difficult for drivers to see clearly which makes them vulnerable to accidents especially as there are huge trucks driving on the road.

4.2.4 Document and picture analysis in relation to the prevalence of disasters in South Africa

Reflecting on what literature has recorded on issues pertaining to the prevalence of hazards and disasters in South Africa, most data were gathered from scholarly articles, newspaper articles and policy documents from international organisations such as ISDR, UNEP, UNESCO and NMDC. According to the NDMC framework (2005:1), South Africa faces increasing levels of disaster risk. It is exposed to a wide range of weather hazards, including drought, cyclones and severe storms that can trigger widespread hardship and devastation. In addition, South Africa's extensive coastline and proximity to shipping routes present numerous marine and coastal threats. Similarly, our shared borders with six southern African neighbours present both natural and human-induced cross-boundary risks, as well as humanitarian assistance obligations in times of emergency.

According to Mayosi et al. (2009:34) South Africa is in the midst of a health transition that is characterised by the simultaneous occurrence of epidemic infectious diseases and a rise in non-communicable diseases, in a population facing a heavy burden of prenatal and maternal disorders, injury, and violence. Cardiovascular disease, type 2 diabetes, cancer, chronic lung

disease and depression are the major non-communicable diseases now reaching epidemic proportions in the former socialist states and low-income regions of the world. Bradshaw et al. (2000) maintain that by 2000 South Africa experienced a unique quadruple burden of disease experienced in a combination of the pre-transitional diseases and conditions related to poverty, the emerging chronic diseases, injuries and HIV/AIDS.

Acutt, Medina-Ross and O'Riordan (2004:309) argue that in South Africa, the history of many communities, both formal and informal, surrounding chemical facilities has been shaped by apartheid planning that resulted in racial zoning associated with industrial development.

An analysis of pictures taken in Ivory Park and Khayelitsha informal settlements reveals that these areas experience multiple hazards. Picture 1.1, 2.1, 2.2 and 4.1 reflect the complexities that characterise the vulnerabilities of the two informal settlements but could be similar to other informal settlements in South Africa as well. Picture 1.1 and 2.2 depict Ivory Park informal settlement hazards. Picture 1.1 depict shacks directly facing the storm water pipe with eight water channels. The number of the water channels and height of the storm water pipes reflect that engineers and architects expect that a high volume of water might pass through. Considering the weak materials used to build shacks such as cardboard boxes and plastic, one wonders how disastrous it would be if a storm hits the Ivory Park area. Picture 2.2 depicts a different angle of the Ivory Park informal settlement, providing another dimension to disasters experienced in the area. The picture depicts multiple hazards such as high voltage electric cables with some shacks built underneath the poles and cables. The chances of these shacks being destroyed by fire from the electricity and lightning are high. Furthermore, the picture depicts the sewerage pipe passing among the shacks. The danger with sewerage pipes running through the shacks is that if they burst the residents of the informal settlement will experience health challenges. Some of the dangers of this type of hazard are reported in 4.3.3 where the press raised the alarm about residents of informal settlement around Jukskei River facing a possible disaster from a deteriorating sewerage pipeline.

4.2.5 Discussions on the findings of questionnaires, interviews and literature review in relation to the prevalence of hazards and disasters in South Africa

The interviewed participants made it clear that fires, floods and droughts were the main prevalent hazards in South Africa followed by storms, sinkholes and accidents such as industrial explosions, and spillages from rail and road accidents. Other hazards identified by the participants include epidemics (such as HIV/AIDS, foot and mouth disease, rift-valley fever and avian flu), water quality, extreme cold, heat waves, social conflict and fog. The significance of identifying these hazards is that it helps in the development of curriculum and instructional design. While not every disaster needs to be included in teaching in just one grade, the teaching could be spread across different grades, from foundation to senior phase. The combination of natural hazards, epidemics and human vulnerability and risks increases the magnitude of disasters. These disasters have severe implications for education because in some instances learners are unable to go to school or are affected by the disasters when they are at school or on their way home. The greatest challenge for the education fraternity is whether to respond to this by including all these hazards in the curriculum or not.

Data collected through the interviews were consistent with the comments made in the questionnaire where educators identified floods, veld and shack fires, droughts and road accidents as hazards experienced in their area. Additional information emerging from the questionnaire comments included the potential hazards that could be caused by medical waste carelessly dumped next to communities and falling trees as a result of storms. Compared with data from the literature review, Mgquba and Vogel (2004), Napier and Rubin (2002), Reid and Vogel (2006), Vogel et al (2007), Frost-Killan (2008), the NMDC report (2009) and *The Times newspaper* (2009) all support the evidence that floods are a serious hazard in South Africa. Fire and droughts are mentioned as other types of hazards affecting South Africa. It is, however, important to note that Mgquba and Vogel (2006:30) emphasise that future changes in climate as well as changing social conditions including the role of HIV/AIDS, governance and conflict pose huge challenges to society. Napier and Rubin (2002) argue that natural disasters that affect people in informal and tradition settlements most adversely are floods, famine, drought, fires, wind storms and epidemics. They further state that creeping disasters that relate to conditions of

poverty such as high infant mortality, HIV/AIDS and other illnesses should also be considered. A Harvard publication (2002) notes that the current HIV/AIDS epidemic could be considered a disaster in a number of nations, especially in sub-Saharan Africa because there is substantial evidence indicating that in nations afflicted by the epidemics a serious disruption of the functioning of society begins to occur.

Newspapers and television news have extensively reported floods and fires that affect South African communities and neighbouring countries. There is therefore strong evidence that data gathered through questionnaires and interviews are congruent with the literature review. Moreover, some of categories identified in the Shaluf (2007) disaster tree and what was identified by the National Disaster Management Centre (2005), Mulegeta, et al. (2007) and some scholars as discussed in Chapter two are congruent. Since it has been ascertained that South Africa is likely to be hit by disasters and is currently experiencing some forms of hazards, it is essential to determine the extent to which South African communities are vulnerable to such disasters.

In Chapter two, Hartnady (2010) was quoted saying that a major earthquake disaster in the region is inevitable because wide areas of southern Africa are affected by the slow southward spread of the East African rift system. He stresses that it is not a question of if, but when. This prediction combined with Frost-Killan (2008) who was quoted in Chapter one saying South Africa has a history of geohazards and disasters such as having the deepest mines in the world with some going down nearly 4km that lead to high rates of seismic activity from gold mining districts, that are higher than elsewhere in the world. Sinkholes found in underlain and dolomite show that instability could result in unstable soil, resulting in the collapse of mountains. These activities might trigger an earthquake, landslide even huge sinkholes.

In summary, the sub-question 1, posed as, *what hazards and disasters are prevalent in South Africa?* has been addressed in the discussions above. The literature review, questionnaire respondents and interview participants provided conclusive evidence that South Africa has a prevalence of major hazards such as floods and fires and it is experiencing other hazards and disasters such as droughts, storms, epidemics, social conflict reflected as xenophobia, road

accidents, chemical spillage and minor hazards such as cold weather, lightning, fog and heavy rains. Even though the country has not experienced major disaster such as earthquakes, volcanic eruptions or hurricanes, these catastrophic events nevertheless should not be ruled out as a possibility. Moreover, global change experts are concerned, as reported by van der Walt (2010:14), that irreversible man-made alterations to the global environment that have a negative impact on the ecosystem most obviously have potentially serious consequences for human well-being. This idea is supported by Barnard and Underhill (2010:28) who maintain that these are rapidly changing times for the rest of the world as climates are changing perceptibly and people and industries are altering the landscapes in dramatic ways that are unprecedented in human history with pollution and toxins all around us.

The categories emerging strongly from the interview responses were floods and fires followed by droughts and accidents such as industrial, road, rail and spillages. Two respondents identified HIV/AIDS as a hazard while new hazards such as fog alongside the N4 highway, cold weather, heat waves, water quality and epidemics such as rift-valley and foot and mouth disease show that South Africa is experiencing many hazards that could easily result in disasters.

What emerged strongly from the responses of P2, P6 and P8 is that there is a need to differentiate the concept hazard from disaster as they mean two completely different things. In fact P2 and P8 maintained that the questions incorrectly referred to disasters and P2 suggested that the interview should refer to hazards and vulnerability, while P8 stated that it should focus on disaster risk reduction. However, the question posed asked what hazards and disasters are prevalent in South Africa and the respondents were expected to distinguish between hazards and disasters.

While floods and fires emerged as major hazards prevalent in South Africa, one hazard that cannot be ignored is the fog mentioned by P10. The same day I was working on the interview transcript, I watched the seven o'clock E-TV news on 13 August 2010 which reported an accident that happened when a truck was trying to make a u-turn and was hit by a 1400 Nissan bakkie which was subsequently hit by a truck. The driver of the Nissan 1400 died on the spot while the passenger was taken to a nearby hospital and was in a critical condition. The cause of

the accident apart from the truck driver who was doing a u-turn was a dense fog as the E-TV video footage showed.

In conclusion, the responses have provided a fair amount of data to make a decision whether South Africa has a problem with hazards and disaster. It is important for learners to know and understand the types of disasters affecting their community, province and those affecting the entire country. They should also be taught about disasters that are affecting the global community as these are important in case learners find themselves visiting some of the countries affected by specific disasters. The questionnaire responses have shown that educators were aware that their area could be affected by disasters and the next step for them is to develop learning programmes including unique disasters that have been identified by interview participants such as epidemics, natural hazards, human-made and hybrid disasters. The next section will discuss the findings of sub-question 1in relation to the results of questionnaire, interviews and the literature review.

4.3 An analysis of data collected to determine the extent of South African communities' vulnerability to disasters

Sub-question 2 of this research intended to determine the extent to which South African communities are vulnerable to disasters. The inclusion of this sub-question was motivated by numerous scholars such as Reid and Vogel (2006:195) who report that rural, resource-poor communities currently experience a number of stressors that curtail livelihood options and limit the quality of life and Napier and Rubin (2002:3) who point out that it is interesting to note how discussions about informal settlements and the livelihoods of people occupying such settlements have begun to intersect with the discussions and rhetoric around environmental hazards and disaster risk management. In Chapter two, section 2.3, the issue of vulnerability was discussed in depth. Scholars such as Reid and Vogel (2006:196), Mgquba and Vogel (2004:37) and Napier and Rubin (2002:5) argue that communities residing in informal settlements are more vulnerable and are the ones who suffer greater losses than their counterparts in established settlements. King (2000), Gaillard (2007: 534), Napier and Rubin (2002:3), Reich (2006:796), Pelling (2003) and Mgquba and Vogel (2004:34) stress the fact that poverty contributes to vulnerability of

communities and is reflected in structurally poor houses and vulnerable areas, which increase the chances of these communities becoming victims of disasters.

4.3.1 Educator responses to the extent to which South African communities are vulnerable to disasters

Although there was no specific question that asked educators about the extent of their communities' vulnerability to hazards, some educators provided data under the additional comments section that addresses the extent of South African communities' vulnerability to disasters. For example, a respondent (R7) from the Western Cape commented that:

> *Most of our learners live in shacks; this alone makes them to experience disasters because of hazards like fire and flood.*

Another respondent (R8) from the Western Cape commented that:

> *There is a need for hazards to be included in the curriculum because in our area there is an informal settlement and the community is also affected by floods.*

It was stated in a previous section on the prevalence of hazards and disasters in South Africa that a Western Cape respondent (R4) showed concern about medical waste dumped in Khayelitsha that was easily accessible by school children of whom some were seen injecting one another. To emphasise how storms are experienced in the Eastern Cape, R9 commented as follows:

> *One of the local schools was recently blown away by wind storms and there have been some houses which burned from fire. In the Eastern Cape some houses are built with raw bricks made of mud and when it rains heavily, these houses are eroded which forces the inhabitants to leave their homes.*

These few comments provide evidence that educators are aware of the extent to which their communities are vulnerable to disasters. This evidence is complemented by the fact that 95.3 percent of the 150 respondents who completed the questionnaire as discussed in 4.2.1.1 of the previous section indicated that there was a likelihood for their area to be affected by disasters. The significance of the responses here is that respondents have commented on some issues of

poverty which the literature review emphasised, that although disasters affect everyone in the vicinity of the outbreak, it is poor people who suffer the most. A respondent mentioned that people living in a house made of mud bricks usually experience problems during heavy rains. Recently SABC news reported on two families struck by lightning in KwaZulu-Natal in December 2010. The deaths of more than five family members in each incident were noteworthy for the fact that these families were living an a mud house with a grass roof. The question that arises here is whether school education could have saved the lives of the KwaZulu-Natal families. In the literature review some scholars emphasised that disasters happen fast and in most cases are unexpected which makes it difficult for people to survive. Ronan and Johnston (2001:1056) although sceptical about the effects of hazard education programmes maintain that they might help and specifically mention the turtle response as another way that learners could survive. Here, if the two KwaZulu-Natal families had been taught about the turtle response where a person is expected to crawl to the nearest exit and avoid standing, they might have survived.

It would be essential for educators to start assessing what disasters are likely to affect learners based on the environment they come from, such as those that live in shacks; those that have to cross rivers and streams; those that have to cross busy roads. More importantly they would have to assess any other potential hazards that may result in death or other catastrophic outcomes.

4.3.2 Interview responses in relation to the extent to which South African communities are vulnerable to disasters

The participants who participated in the interviews were not asked directly to give their views on sub-question 2 as it was to be addressed from the literature review. The respondents were asked to name disasters that were prevalent in South Africa and it became apparent that some respondents, while addressing the first sub-question, automatically addressed the question about the extent to which South African communities were vulnerable to the identified disasters. As indicated in the previous discussions of sub-question 1 that South African communities are vulnerable to specific hazards and disasters.

The response of P1 showed that other countries experience disasters; South Africa has not seen major catastrophes but there are small scale hazards such as earthquakes being reported, storms that recently affected Musina next to the border with Zimbabwe. Although there was no loss of life as a result of the storm, the incident left people destitute as their houses were destroyed as well as property, furniture, cars and food. Schools in the area were damaged and luckily the storms sprung up during the night otherwise learners would have been highly affected. P1 further stated that South Africa would be hosting the FIFA soccer world cup in June to July 2010 and that there was a need to ensure that disaster risks such as those caused by terrorism, stadia collapsing and fatal roads accidents were reduced. A task team was established specifically to look at what possible disasters could happen during the soccer world cup and make plans to mitigate such risks.

P2 stressed that hazards are not an issue of concern as the human race has been living with them through one generation to another. The problem arises when these hazards are linked to the vulnerability of communities as paraphrased below:

> *The issue to understand is that these hazards are here all the time and it is not an issue, take droughts and floods as an example, we will always have those, the problem is when you link the hazard to vulnerability then it becomes a disaster. If there is no vulnerability the hazards will happen anywhere all the time and there would be no problem as people will learn to cope.*

P2 further stated that in her current work, she tried to ensure that the legal framework on disaster management focused on risk reduction issues which are in essence vulnerability issues. She was a member of the Intergovernmental Panel on Climate Change (IPCC), and they have focused their work to have issues of vulnerability take centre stage as they are essential if we are to win the war against disasters. P2 gave examples of floods and the earthquake in Haiti to illustrate the role of vulnerability. On issues of floods, P2 maintained that it is not a problem as long as communities do not settle or build roads in areas prone to flooding or prevent the water flow to the river. Another example given by P2 to support the statement is that the Haiti earthquake was devastating because of people and structural vulnerability and most of the people who suffered heavily were the poor residing in marginal areas. The participant further stated that the massive hurricane Katrina could be used as another example in that a large sector population that was poor and consisting mostly of the black population of the city was largely affected. To illustrate

the effect of vulnerability, P2 believed that if the hurricane had struck the affluent and white population the damage would have been minimal because of the structural resilience of the houses in the vicinity.

P2 emphasised that if the issue of vulnerability is not understood and there is no best science generated on the phenomenon, we will miss the boat all the time and end up with a small event ending up becoming a devastating disaster. R2 stressed that it is not the prevalence of disasters that we should be concerning ourselves with but how vulnerable communities are to disasters.

P3 maintained that South Africa was fortunate not to have experienced any disasters like tsunamis, volcanic eruptions and earthquakes such as that in Haiti, Japan and Chile. Most disasters experienced in South Africa do not lead to mass death as in Haiti where more than 700 000 people died. The South African incidents only require that victims be handed humanitarian relief necessities such as shelter and food. There is, however, still loss of life in some incidents such as flood, truck accidents and mining accidents in South Africa. Most South Africans are not aware that disasters such as earthquakes, storms and volcano eruptions could happen in their area. Even though they are aware of floods and fires, they do not think that these could increase in magnitude.

P4 added his voice by saying that Gauteng experienced disasters such as floods, shack fires, dolomite, sinkholes and in some instances communities experience extreme cold weather. Disasters are area-specific, for example, Alexandra township has experienced much flooding and many shack fires while other areas like Germiston and the West Rand have experienced sinkholes and houses have developed cracks. What is referred to as a disaster at Jukskei River informal settlements may not necessarily be seen as a disaster. Fires that are raging in the province in some informal settlements, or in industrial buildings and on farms are specific to that area. Car accidents are problematic, especially during the festive season. You hear that in Gauteng more than 300 people have died and most deaths are taxi and bus related. There are some train accidents but they mostly involve people crossing railway tracks without looking. But cars, buses and trucks ferrying people are sometimes involved in train accidents.

P5's views on communities' vulnerability were that these disasters do affect the community very much. Floods were problematic because people were now building houses in areas that are not demarcated for human settlements. Building houses in a mountainous area above a river is a recipe for disaster because all water that flows from the mountain to the river will first destroy any structure in its way. Like other participants, P6 stressed that floods were now becoming serious because of the establishment of new settlements where streams of water used to run. New buildings and big roads cause water to be rechanneled, making the communities susceptible to flash flood disasters.

According to P7, the recent floods in the Northern Cape affected communities residing close to the river banks, especially those that built shacks in an informal area. Schools were also affected by the floods.

P8 stressed the fact that the hazards (listed in 4.2.2) were prevalent and they would continue to bother communities. What mattered most was to have disaster risk reduction strategies to ensure that communities did not get seriously affected. P9 commented by giving an example of how communities were vulnerable to spillages of dangerous materials from road and rail accidents by stating:

> *Sometimes trucks transporting dangerous materials and chemicals pass through cities and there are possibilities for accidents to happen as they move with dangerous materials on a daily basis in South African roads. For example, informal settlements of Alexandra, Tembisa and other areas within the country in which shacks are built next to the tar roads and railway tracks. This is potentially dangerous if one thinks of the chemicals in the tankers.*

This comment is linked to a response by P3 who was concerned about people's behaviour of always running to the scene of an accident just to watch and not do anything to help as reflected in the phrase below:

> *When there is an accident, people run towards an accident scene without knowing what is happening.* I*n one instance we responded to an emergency where a truck was transporting cyanide which is a dangerous chemical and on the scene there were people just watching without knowing what was in the truck.*

There was a possibility of a disaster if there had been an explosion and spillage occurred. Many onlookers could have been affected; luckily the danger was averted before the chemical was released.

To support the notion that South African communities are vulnerable to disasters, P10 maintained that:

> *The SASOL plant in Mpumalanga poses threats to the neighbouring communities since it deals with highly hazardous materials and the pipe could burst or tankers could spill the hazardous materials which could heavily affect the community residing nearby. A similar accident once happened in Mpumalanga but not many people were affected.*

The responses above provide relevant data to prove that the participants think that South Africa is vulnerable to a great extent to some of disasters like floods, fires and accidents.

4.3.3 Documents and picture analysis depicting the extent to which the informal settlements are vulnerable to disasters

According to Napier and Rubin (2002:5), natural disasters that affect people in informal and traditional settlements most adversely are flooding, famine, drought, fires, wind storms and epidemics. As noted earlier, the creeping disasters, which relate to conditions of poverty such as high infant mortality, and deaths from HIV/AIDS and other illnesses, are also not captured in these figures. Technological disasters, affecting informal settlement residents, included transportation accidents, industrial accidents, and other miscellaneous accidents which accounted for the loss of lives. The miscellaneous accidents category included fires in informal settlements – and again the number of deaths from such events is vastly under reported. An analysis of Picture 2.2 reveals that the Khayelitsha informal settlement is located next to busy railway lines and according to the article from Railway Africa News reported in section 2.3, this settlement poses a high risk that includes theft, vandalism and sabotage of rail equipments. The most worrying aspect is that stealing of electric cables and other equipment happens at these informal settlements which could easily lead to an accident involving a train transporting hazardous materials.

4.3.4 Discussion of the data collected through interviews, questionnaires and literature review to address the extent to which communities are vulnerable to disasters

In Chapter two Section 2.3 I stated that disaster scholars and to a lesser extent the general public have acknowledged that disasters do not distribute risks indiscriminately; issues of poverty (Fothergill & Peek: 2004), housing (King: 2000, Napier & Rubin: 2002), being underprivileged (Alexandra: 1997), geographical marginalisation (Gaillard: 2007), and health (Bull-Kamanga et al.:2003) are at the centre of vulnerability. The Green Paper on Disaster Management (1998) maintains that like other countries, South Africa is at risk from a wide range of natural, technological and environmental hazards that can lead to disasters such as droughts, floods, major fires, major oil spills and even earthquakes.

My impression here is that South Africa is vulnerable to a greater extent to disasters such as flood, fires, and droughts, industrial and technological accidents. HIV/AIDS is fast becoming a disaster in South Africa, considering that the prevalence rate was standing at 18.8 percent by 2005 as reported in a study conducted by Weltz, Hosegood, Jaffar, Batzing-Feigenbaum, Herbst and Newell (2007) in KwaZulu-Natal, and which proved that South Africa has one of the highest HIV infection rates in the world.

Weltz et al. (2007:1472) found a prevalence of 21.5 percent among residents of KwaZulu-Natal rural areas where two-thirds of the population lived in sparsely populated areas, combined with evidence that non-participants may be at a higher risk of HIV, and the much higher infection rates among mobile non-residents who make up 30 percent of household members suggest that the burden of HIV in rural areas of South Africa may be higher than previously estimated. The authors reported that UNAIDS revised the South African HIV prevalence estimates from 20.9 percent to 18.6 percent with the 2005 estimates being 18.8 percent. These revisions and decline of statistics are an indication that HIV/AIDS is currently one of the highest causes of death in South Africa which in itself is an indication of a country moving towards disasters. HIV/AIDS should be treated as a disaster and should be given necessary attention through inclusion in the national curriculum and be taught to learners as such.

Data collected through the literature review, interviews and questionnaires provided evidence to determine the vulnerability of South African communities to disasters such as flood, fires, storms, epidemics, accidents, sinkholes, medical waste, and chemical spillages and weather related hazards. Climate change, technological and social development and people mobility could easily turn hazards that people were used to living with into disasters.

The Star of 24 August, 2010 reported that there was a possibility of a sewerage pipe burst in the Jukskei River area threatening the wetland and the communities surrounding the area. English (2010) of *The Star* reported this possible hazard in this way:

> *A total of 430 million litres of raw sewerage flow through Dainfern, Jo'burg pipeline every 24 hours, but the pipeline is deteriorating and is on the verge of bursting due to vandalism that leaves the pipe exposed to the element as people steal the aluminium sheets.*

English (2010) further reports that if the pipeline burst, it would flow from Diepsloot through to the Jukskei River. The material in the sewage would kill everything in its way and would pose a health risk for animals and informal settlement residents who lived along the riverbanks and used the water directly from the river. It was good that the municipal authority gave the assurance that there was a disaster management plan to deal with the burst if it occurred. However, one wonders whether the informal settlements in the area, especially the children were aware and prepared for this looming danger to their lives.

Although South Africa has not experienced earthquakes, volcanoes or hurricanes lately, it is important to heed Chris Hartnady's (2010) caution as reflected in 4.2.3 that an earthquake could happen in Southern Africa any time. Issues of medical waste dumps, changing climate conditions and extensive development should be noted. Something to consider is that most of the vulnerabilities identified by interview participants related to human-induced incidences rather than natural hazards. If Shaluf's (2007) disaster tree is considered, the disasters that South Africa is mostly vulnerable to could be categorised as hybrid or chronic disasters as P2 suggested. Hybrid disasters refer to those hazards which communities could live with but that could become catastrophic if communities were ignorant. For example floods would not pose much of a problem to communities who were always aware and built their structures to resist and channel

water appropriately. However, if people built their shelters on the river banks or next to the streams without properly channelling the water then a disaster would definitely happen. This is the case with informal settlements where people built their shelter without much planning. Chapter two, picture 2.1 of Ivory Park informal settlement depicts shacks erected next to multiple storm water pipes, which is highly dangerous.

The problem of informal settlement vulnerabilities is serious and not just because it was identified by some interview participants or reported in the newspaper and television. The researcher has been exposed to risks in these informal settlements when, in 1994 his family moved from a rented place to buy their own place in what is now known as Portion 9 in Hammanskraal. It is situated between the Apies River and the R101 to Warmbaths. There is also a railway track between the Apies River and the informal settlement where goods trains transport merchandise from and to neighbouring countries on a daily basis. When they settled in that area, it was a wonderful place but a few years later it had turned into a nightmare for the inhabitants. There has been much development since then which included the elevation and widening of the R101 road to prevent pedestrian accidents. Storm water pipes were laid to channel water without much consideration to the Portion 9 residents who subsequently dumped rubbish in the storm water pipes. Since the water could not pass, it either dammed or moved underground on the R101 and subsequently irritated the Portion 9 residents. As of now, the Portion 9 residents were experiencing challenges with sanitation as they did not have sewerage and relied on pit toilets which were always full because of underground water. Every rainy season, the community of Portion 9 experiences multiple hazards such as floods, mosquitoes, rubbish that flows through their yards; not to mention the dirt flowing from pit toilets in the area.

It is therefore important to raise awareness in communities about their vulnerability to a variety of disasters. Education has been hailed as one of many ways to raise awareness to learners. The next sections will focus on an analysis of data collected to determine whether education contributes to raising this awareness of learners about hazards and disasters.

4.4 An Analysis of data collected to determine how the national curriculum caters for the teaching of hazards and disasters

4.4.1 Literature review to determine how the national curriculum caters for the teaching of hazards and disasters

Following are discussions on how the national curriculum caters for the teaching of hazards and disasters drawing from the questionnaire and interview responses. Kirk and MacDonald (2001:552) maintain that any curriculum reforms that try to by-pass teachers or that are overly prescriptive will not succeed to achieve their aims. This phrase has implications for the NCS in South Africa especially considering Jansen (1999), Mason (1999), Botha (2001) Rogan and Johnson and other scholars who allege that educators were not involved at the initial stages of development and implementation. The empirical data collection provided an opportunity to determine whether educators were not involved in the development and initial implementation of curriculum reforms in South Africa. Although the emphasis of the study was on checking whether the curriculum reforms in South Africa catered for the teaching of hazards and disasters, it is important to reflect on what international scholars on curriculum and teaching of hazards and disasters have recorded.

Most of the curriculum scholars recorded in Chapter two agrees that changes in society necessitate curriculum reforms and therefore curriculum has to respond to the changes in society, Teodora and Estrela (2010:623) consider globalisation as a key driver of reforms, Popkewitz (2010:304), Wraga and Hlebowitsh (2003), Osler (2011:2) and Green (2010:452) consider political and social imperatives as drivers of curriculum change, while MacDonald et al. (2002:260), Kirk and MacDonald (2001:552), Osler (2011:1) and Brooker and MacDonald (1999:85) support the role of teachers as key drivers in curriculum development. Doll's (2003:282) assumptions that education is moving from copy-model curriculum, emphasising rote learning, to discovery curriculum is relevant here as a key driver in South Africa's adoption of Outcomes-Based Education which emphasised a learner-centred education approach.

It was discussed in Chapter two that South Africa's ever-changing national curriculum was introduced as Outcomes-Based Education in 1997, underpinned in Curriculum 2005, received a face-lift in 2001 and became National Curriculum Statements (NCS), is currently being reviewed and a new proposal is being discussed through a document named Curriculum Assessment Policy Statements (CAPS). Each facelift coincided with a new minister appointed to lead the National Education Department. The question that comes to mind is will the South African curriculum undergo changes every 5 years when a new minister is appointed. Another question that arises is whether the changes are addressing questions being asked. These two questions cannot be dealt with here but should serve as research questions for future studies. The significant question that needs to be raised here is whether the changes as they were introduced took into consideration the inclusion of hazards and disasters outcomes in the national curriculum.

Curriculum reforms in South Africa were concerned with the introduction of OBE which aimed to develop learners so that they work effectively with others as members of teams, groups and communities, used science and technology effectively and critically, showed responsibility towards the environment and health of others and demonstrated that the world is a set of related systems by recognising that problem solving contexts do not exist in isolation. The NCS provides opportunity or pointers for educators to include the teaching of hazards and disasters in various ways. The first pointer is that learners are expected to understand and demonstrate responsibility towards the environment, the second pointer is that educators are allowed to develop their own learning programmes which take into consideration local challenges affecting communities indiscriminately.

It has been acknowledged in Chapter two that curriculum plays a central role in teaching learners about hazards and disasters mainly because educators follow the curriculum as it is and textbook writers or learning programme developers use learning outcomes listed in the NCS as guiding principles. Also, while the NCS implicitly allows for the teaching of hazards and disasters, it is only in Grade 7 and in Grades 10 to 12 Social Sciences where learners are explicitly taught about hazards and disasters. With this information at hand, it is my view that literature and policy documents do not convincingly show that the inclusion hazards and disasters in the national

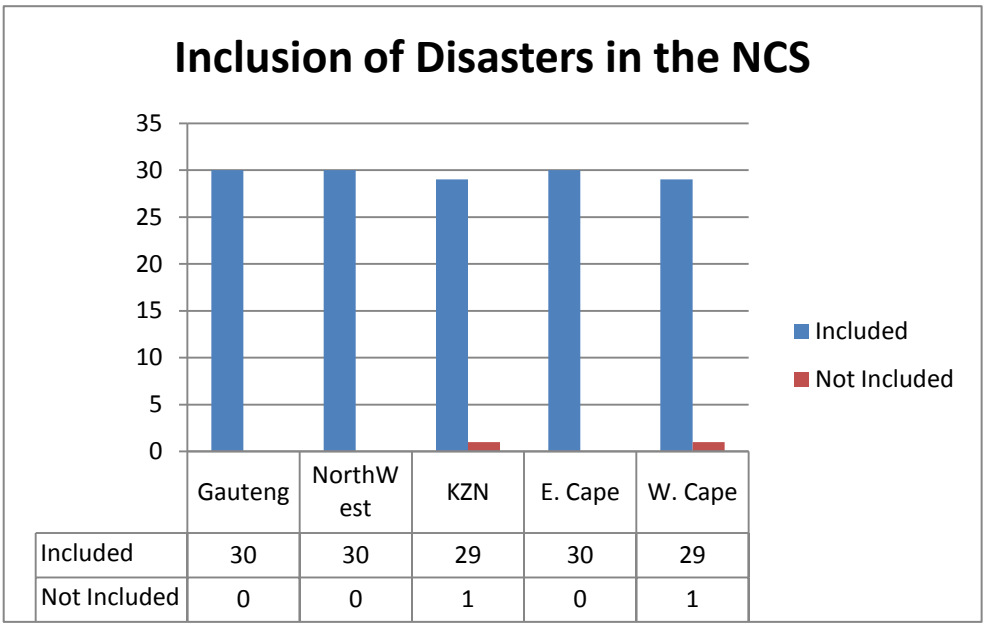
curriculum has been given the attention it warrants. The development within the South African education provides opportunity for change as discussed above. The idea of ever changing is supported by scholars such as Popkewitz (2010:308), Smith and Lovat (2003:193), Glatthorn, et al. (2006:96) and Slattery (2006), Carl (2009:40), Schiro (2008:36), Green (2010:455) and Wraga and Hlebowitsh (2003).

4.4.2 Questionnaire responses in relation to the inclusion of hazard and disaster learning outcomes in the national curriculum

The intention of sub-question 3 was to determine whether educators agreed or disagreed with the inclusion of teaching about hazards and disasters in the national curriculum. This question is essential for educators because it sets out to address the assumption that if educators' responses are positive they will teach learners about hazards and disasters. But if their answers are negative then they will not teach learners about hazards and disasters as it is not important.

4.4.2.1 Chart display of educators' response to the inclusion of learning outcomes on hazard and disaster in the national curriculum

A total of 150 educators responded to this question. One hundred and forty eight respondents indicated with a 'Yes' that hazards and disasters should be integrated while only two disagreed by selecting 'No', which implies that hazards and disasters should be included in the National Curriculum Statements. In terms of percentages, 98.6 percent supported the idea while only 1.4 percent thought it was not a good idea. The responses to question two in the questionnaire indicate that the majority of educators from five provinces sampled believed that hazards and disasters should be included in the national curriculum. Only two candidates, one from KwaZulu-Natal and the other from the Western Cape, responded that the national curriculum should not include hazards and disasters. The chart below provides evidence of the respondents:



	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Included	30	30	29	30	29
Not Included	0	0	1	0	1

Figure 4.2: Chart display of educator responses in relation to the inclusion of hazards and disaster learning outcomes in the national curriculum

The conclusion that arises from question two's responses is that 98 percent of all educators who responded to the questionnaire agreed that inclusion of hazards and disasters in the school curriculum is essential. The significance of the responses in this chart is that they give an indication of whether respondents believed that hazards and disasters should be included in the national curricula. Of interest is the link between this question and the previous question. Since the majority of educators who participated in the study were aware that their area could be affected by disasters, the majority of them also believed that hazards and disasters content should be integrated into the national curriculum. What these questionnaires did not address is at what level should hazards and disasters be included and how much should be included. Another point coming out of the analysis of data collected through questionnaires is that the data do not tell whether educators are aware that hazards and disasters are included or not in the national curriculum. This information could have added more evidence about the contribution that curricula have on learner awareness on hazards and disasters. An analysis of interviews however has in some instances addressed some of the gaps which emerged during an analysis of questionnaires response in relation to the manner in which the national curriculum caters for the teaching of hazards and disasters.

Of the 35 respondents who made additional comments only nine explicitly mentioned the inclusion of hazards and disasters into the NCS. Some of the comments are listed below.

A respondent (R10) from the Western Cape commented not only on the inclusion but went a step further to suggest grades in which these hazards should be taught by stating the following:

> *Hazards and disasters should be included in the NCS from grade 1 to all other grades.*

To add to the inclusion of hazard and disaster learning outcomes in the national curriculum by nine respondents, (R4) from Gauteng stated the following:

> *Hazards and disasters should be integrated in NCS Life Orientation. At the moment the hazards and disaster learning outcomes focus on international hazards and less on the South Africa situation.*

These comments coupled with the response to the closed-ended question provide relevant evidence to decide whether educators agree that hazards and disasters should be integrated into the National Curriculum Statements. Since this has been established the next section will explore whether the specialists interviewed agreed about the integration, at what level the integration should happen and whether the issue had been adequately addressed.

4.4.3 Interview responses on how the national curriculum caters for the teaching of hazards and disasters in schools

The participants were interviewed on whether hazards and disaster education should be integrated in the school curriculum and at what level or grade the integration phase should be done. The follow-up questions were intended to solicit more data to give depth to the evidence of whether hazard and disaster learning outcomes should be integrated in the school curriculum, collected through literature and questionnaires.

P1 stated that disaster risk reduction should indeed be integrated into the NCS as mandated by the National Disaster Management Act of 2002 and the National Disaster Management Framework Enabler 2, which requires that hazards and disasters be integrated into the school

national curricula and in classroom teaching. Referring to the grade and level of inclusion, P1 stated that,

> *sustainable development concerns all levels from the foundation phase, intermediate right through to senior phase and tertiary level learners should be taught about hazards and disasters.*

P2 responded by stating that disaster risk reduction was essential and should be included in the school curriculum. P2 was certain that hazards and disasters are already included in the National Curriculum Statements learning outcomes for Grade 10 Social Science as they were already studying hazards, like volcanoes, earthquakes and cyclones but noted that it was a bit late as it should start earlier. P2 suggested that teachers could use rainfall, water issues and other environmental subjects such as deforestation as the content for teaching hazards and disasters since these aspects are part of the approved learning outcomes in the national curriculum statements. She also suggested that,

> *the integration should not only be done in Social Science but it should include all learning areas; Natural Science, Economics and Management, language, human sciences, Life Orientation as well as Mathematics. At tertiary level universities should ensure that all students are taught about disasters so that they could be able to integrate it in all spheres of their work life. For example, engineers and architects will ensure that the structures they design should be of such magnitude that could withstand the possible outbreak of any disaster, while Economics and Management students will take note that rushing for profits has resulted to negation of safety issues and eventually resulted in disasters.*

According to P3, basic safety issues like taking care of water, one's own health and the environment and consequences of not taking care of these important basics should be integrated as part of the national curriculum. This type of education should be introduced in the early learning phase such as pre-primary and primary schools or at home by parents. P3 added that together with his team, they were enlisting school leavers in extensive training which included basic safety principles, medical and fire skills. He added that it was crucial that educators and learners underwent some sort of training on these issues so that they developed understanding of basic safety principles, first aid and fire skills while at school.

According to P4, hazard and disaster education was already integrated in some grades, both in the intermediate and senior phase but whether that was enough depended on the feedback they

got from educators, researchers and curriculum reviewers. Even though in some grades the learning outcomes do not specify the hazards and disasters, issues such as deforestation, water, health and hygiene and industrialisation provided an opportunity for educators to integrate the hazards and disaster awareness. Learners learn best when good practices start early in their learning phases. Starting at lower levels such as the pre-school and foundation phase or lower school grades would enable learners to better understand hazards that were prevalent in their areas. At this level the focus should be more on disasters that are prevalent and issues of environment that relate to their everyday life.

P5's response was that hazards and disasters were already included in the curriculum through environmental awareness campaigns, community involvement and directly through the Social Science learning outcomes component of Geography as indicated in the NCS. The question is whether educators are teaching learners the hazards and disasters learning outcomes as stipulated in the NCS since there is no assessment mechanism to track it in particular. For teaching hazards and disasters, the respondents preferred to introduce it when learners started to read and write. Grade 3 seems to be the appropriate level to start learning about issues related to hazards and disasters which are context specific.

Regarding curriculum matters, P6 stated that while the provisions to teach hazards and disasters were included in the NCS, there was no depth and width in teaching learners about hazards and disasters. The problem was caused by the translation of the curriculum into textbooks by authors to be used by teachers in their classrooms. Teachers only taught what was contained in the textbook and rarely considered other sources of information. The participant stressed that the teaching was limited to identifying different types of disasters such as earthquake and cyclone without contextualising the teaching to learners situation. This implies that if the textbook is out of context, then the teaching as well could be out of tune. The outcomes of the national curriculum might therefore not be achieved. Curriculum advisors as well were not in touch with textbook authors which created a huge disjuncture. Additional information that emerged from P6 was that there should be a distinction between hazards and disasters. The emphasis of learning programmes should be on hazards rather than disasters because it showed learners that they had responsibility and control to reduce the risk of disasters.

According to P7 hazards and disasters were included in the National Curriculum Statements for Social Science, but as for other learning areas such inclusion was not clear. For Natural Science, disasters were not included but issues of global warming and change as well as the campaign for *Earth and Beyond* touch on issues of volcanoes, earthquakes and drought. Sometimes teachers were not empowered to have flexibility in teaching and they were not aware that the NCS gave them the flexibility to develop and introduce the learning programme that was essential for the learners' development. Regarding the level and stage of learners' exposure to hazard and disaster education, P7 stated that Grade 7 was the appropriate level to introduce disasters and thought that it was not a good idea to add content for learners at a lower phase. Up to Grade 3 learners are grappling with issues of switching from their mother tongue to English as a medium of instruction.

P7 added that sometimes the context was important. Learners residing close to the river banks would need to be exposed to strategies to cope with disasters affecting their area which implied that educators have to develop the learning programmes themselves. If you look at the NCS policy document you have 70 percent content and 30 percent context which makes provision for hazards and disasters. Most importantly, the national department does not prescribe what provincial schools should or should not teach. When the NCS was introduced, the Northern Cape provincial education received a schedule of learning outcomes and out of it they designed the provincial schedule, focusing on issues that were critical to the province.

As far as issues of curriculum integration are concerned, P8 responded that there was a great need to integrate disaster risk reduction into the school curriculum and the focus should not be on disaster management but on risk reduction. Learners should be taught about proper planning, awareness and adopting safe practices. Children should be taught about risks as early as possible before they started school. Parents should be made aware to teach their children about disaster risks as early as possible and all teachers for the foundation phase should be made aware of the need to teach learners about disaster risk reduction.

P9 was in agreement that hazards and disasters should be included in the national curriculum and emphasised that children needed to be taught so that they could notice and identify the level of danger of spillages from trucks or trains and that they should not go near the accident as the contents sometimes consisted of dangerous chemicals such as acids, and airborne effects or contents that may explode and cause fire after the accident. There is a huge need to make learners aware of the dangers related to spillages. While working for the Johannesburg emergency services P9 maintained that they used to visit schools to talk to learners about emergency issues such as first aid and dangers of fire. Teaching should commence as early as possible; for example, mathematics could assist learners in identifying hazards. Another example is that learners in primary school were usually the ones who started fires and in some instances were the ones who got burnt in the fires. The participant mentioned that learners at times played with acid or dangerous materials and as such they needed to be taught not to engage in such risky activities as early as possible.

P10 supported the idea of integrating hazards and disasters into the school curriculum and stated that it was important for learners to be taught about things that affect the community. She maintained that issues that can be integrated into the curriculum are environmental education, pollution, mining sinkholes and awareness issues. Learners must be taught about disasters from foundation phase where they learn about dangers associated with simple things, like not to throw a banana peel where people walk as they will fall and get injured, playing with a match or playing on the roads. Hazard and disaster content should be gradually increased as learners go through to the senior phase. The advantage of teaching learners about hazards is that they spread the message of awareness to their parents and other grownups.

The interview responses have provided essential data to decide whether hazards and disasters should be included in the national curricula. Some of the respondents pointed out that learning outcomes on hazards and disasters are already included in the NCS. However, there is not much data to determine whether it is integrated in the classroom teaching. While Social Science, in particular Geography, have some provisions on hazards and disasters, from the questionnaire, it seems that those that teach hazards and disasters in other learning areas do so of their own accord as it is not prescribed in the NCS.

While other participants felt that hazards and disasters should be included in all learning areas other participants were at pains to demonstrate that other learning areas such as Natural Sciences already include issues of hazards and disasters while dealing with water, deforestation, agricultural and mining issues. It is important to note that the fact that these issues are being taught to learners does not imply that the teaching of hazards and disaster is happening. This matter was explored in a different section of this study as it deals with translation of policy in the classroom. It is important though to mention that another participant noted the disjuncture of what the curriculum stipulates, what gets recorded in the textbooks or learning programmes and what is teaching in the classroom.

While I agree with those participants who maintain that inclusion of hazards and disasters in the national curriculum should be done in the early phases, I am sceptical of the participant who thinks that the integration should only be done at Grade 7. I also support that the integration should consider the level of learners and introduce content that is consistent with their growth level.

4.4.4 Discussions of literature review, interviews and questionnaires on how the national curriculum caters for the teaching of hazards and disasters in schools

According to the National Disaster Management Act 57 of 2002, Article 7 (2g), the national disaster management framework should facilitate disaster management capacity building, training and education. The National Curriculum Statements stipulate learning outcomes for learners to develop general knowledge of natural disasters and epidemics and make informed decisions about social and environmental issues. According to Rao (2007:9) disaster education should begin from childhood; school curricula should be infused with information on hazards such as tsunamis and the precautions that one should take in such vulnerability.

According to the NDMC (2010:10) commissioned report on national education, training and research needs and resource analysis, the conference on disaster risk reduction held on 17 to 18 October 2007 in Jeffrey's Bay adopted resolutions that all places of learning, and especially

places of higher education, should integrate disaster management into course materials across all subjects and ensure that they have educators with relevant skills presenting disaster management. Furthermore, the conference delegates resolved that the South African national Minister of Education should strengthen teaching about disaster risk reduction in the school curricula to develop future adults who are able to identify hazardous situations within their own community and ways of reducing disaster risks through proper application of sustainable development practices.

The NDMC (2010:11) commissioned study on national education training research needs for disaster management concluded the following:

> *Whilst it is acknowledged that educators are already under immense pressure with the current school curriculum, it is a cause for concern that DRM issues are treated in a generic manner in the subjects that include them. This leaves learners in areas where specific hazards occur unprepared to deal with such events. Because of the different hazards-native to different parts of the country - it is recommended that instead of a generic national approach, DRM issues in the school curriculum should be handled in the context of the risks that are present in particular provinces. Also of concern is the limited number of school grades with DRM related material in their courses. It was the findings of this project that grades 5, 6 and 7 were the ones that had the most in-depth coverage of DRM issues. This leaves learners with a very limited exposure to DRM issues in their secondary schooling.*

My impression is that the inclusion of hazards and disasters into the NCS is a welcome development. There is, however, strong evidence that has emerged from the interviews conducted with participants that most of them think that topics on hazards and disasters should be included in the early phase of learning such as the foundation phase where simple basic hazards topics will be taught to learners similar to those suggested by P10 and other respondents. It is important to note that P6 felt that there was no depth and width in the learning outcomes on cyclones, earthquakes and other hazards such as floods and fires. Learners are taught only basics and it is up to the educators to include how to respond when they find themselves affected by fire, floods, storms, earthquakes or volcanoes as listed in the NCS. The integration is in most instances explicitly stipulated only in the Social Science learning area. It would be beneficial if the inclusion was across all learning areas and if learning programmes reflected outcomes for all learning areas. The next section explores how the provisions from the national curriculum could

be translated into the classroom, mainly using the two suggested principles of integration and indigenous knowledge.

4.5 An analysis of data collected to determine the extent to which integrated teaching and indigenous knowledge contribute to learners' awareness and resilience to disasters

According to the DoE report (2003:3), the NCS guidelines on integration and indigenous knowledge serve as a baseline for improving learners' theory, practice and reflective competence as well as assisting the attachment of meaning to the world. Different sources on integrated teaching and indigenous knowledge were discussed extensively and this section seeks to validate those claims in the literature and determine whether these two concepts have the potential to improve learner awareness of hazards and disaster.

4.5.1 Educator responses on the extent in which indigenous knowledge and integrated teaching contribute to learners' awareness of hazards and disasters

Four questions were asked relating to sub-question 4 in this section to determine the view of educators concerning indigenous knowledge, integrated teaching and the inclusion of hazards and disasters in the learning areas and classroom teaching. The first part deals with indigenous knowledge and the second concentrates on integrated teaching. The total of 150 educators responded to each of these questions.

4.5.1.1 Chart depiction of the educators' response to the teaching of hazards and disasters in schools

According to the analysis above, 99.3 percent of educators thought that topics on hazards and disasters should be taught at school while only 0.7 percent thought that it was not necessary to teach learners about hazards and disasters. On the issue of the inclusion of hazards and disasters in their learning areas, 79.3 percent were positive that hazards and disasters should be included while 20.7 percent thought that it should not be integrated. Regarding an integrated teaching

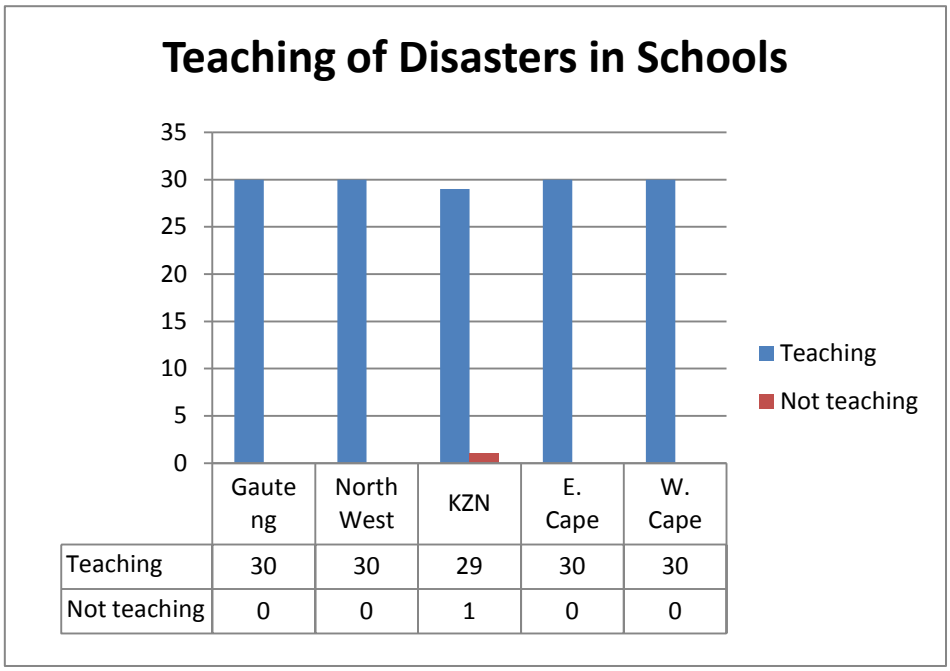
strategy, educators were asked whether they implement it and only 44.6 percent indicated that they are collaborating with other educators while 55.6 percent did not implement an integrated teaching strategy. Regarding issues of including indigenous knowledge in their teaching, 54.6 percent said that they do integrate it while 45.4 percent did not include indigenous knowledge in their classroom teaching.

Almost all respondents agreed that the teaching of hazards and disasters is essential except one from KwaZulu-Natal who seemed to have contrary ideas, as the chart below suggests. Fortunately the respondent was quizzed about the response and chose to stick to the answer and defend his answers by stating:

> *Learners should not be bombarded by dooms issues but by possibilities that life affords to them.*

Respondent (R12) emphasised that the focus should be on science achievements and technological advancement.

The conclusion deduced from the responses is that respondents agreed that the teaching of hazards and disasters to school learners was essential. The comment section has however shed light on new information on the teaching of hazards and disasters. Some respondents are concerned that teaching of hazards and disasters in Grade 7 is not enough. Learners should be exposed to information about hazards and disasters early in their school years.



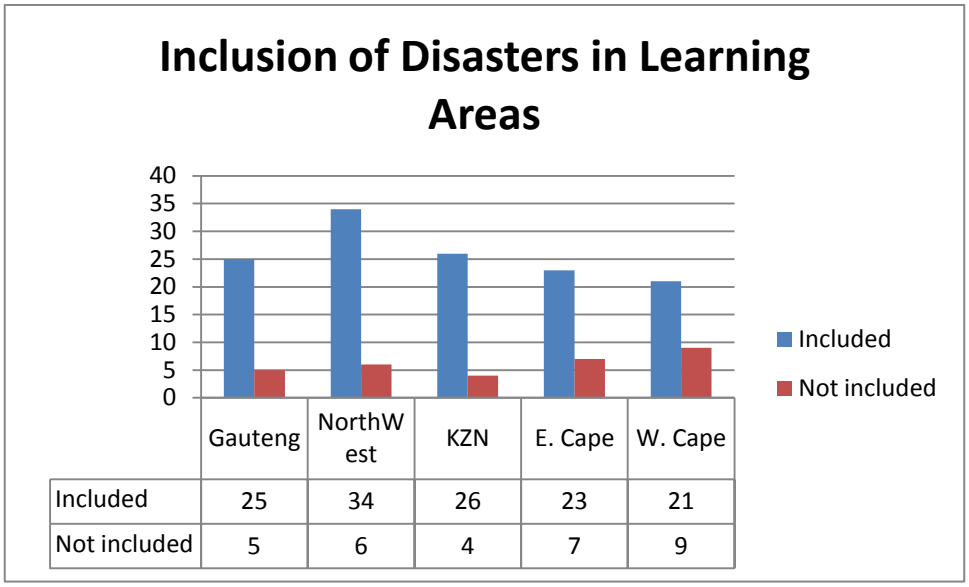
	Gauteng	North West	KZN	E. Cape	W. Cape
Teaching	30	30	29	30	30
Not teaching	0	0	1	0	0

Figure 4.3: Chart display of educators' responses to determine whether they teach learners about disasters in schools

4.5.1.2 Inclusion of natural and human-induced hazards and disasters in the learning area when teaching learners

The response to question 4 shows some more deviation among respondents because the differences per province are clear from the chart below. Twenty five of the Gauteng respondents, twenty four from North West Province, and twenty six from KwaZulu-Natal, twenty three from the Eastern Cape and twenty one from the Western Cape indicated that they included natural hazards and disasters in their classroom teaching. A follow-up in some provinces revealed that Grade 7 educators had such learning programmes or what is referred to as lesson plans in the old education dispensation. It is difficult to compare the findings of this question with the literature study because little or no research has ever touched on the teaching of hazards and disasters in South African schools. The only studies referred to are those that investigate the teaching of Science and most of them concluded that whereas there is teaching of Science in schools, it is not based on the ideals of the new curriculum. The closest study reported in Chapter two was conducted by Ronan and Johnston (2001) who investigated the benefits of hazard and disaster education in helping to increase children's resilience to hazards. Responses to this question

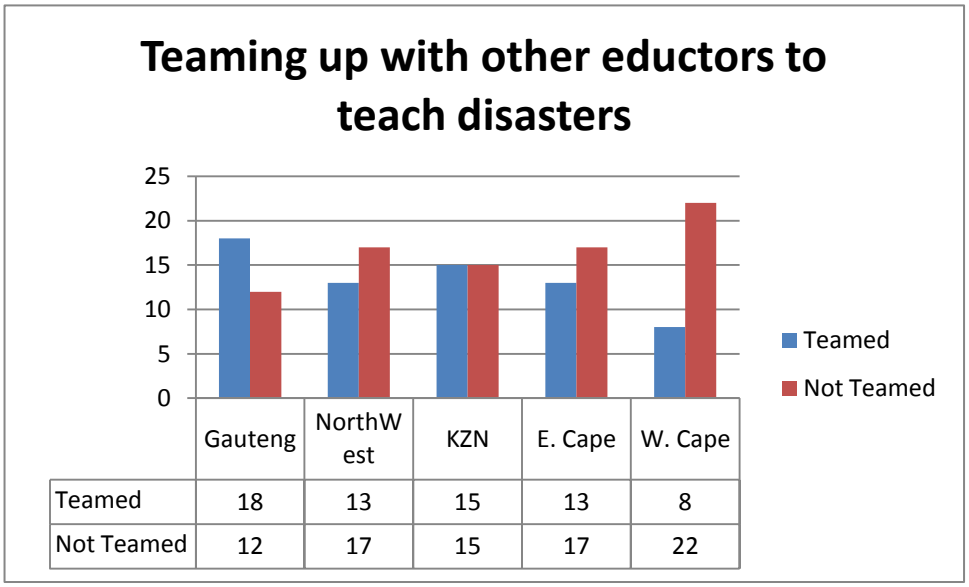
added the most important and valuable insight that the teaching of hazards and disasters in South African schools features in Grade 7 only, mainly because it is part of the learning outcomes of the Grade 7 National Curriculum Statements.



	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Included	25	34	26	23	21
Not included	5	6	4	7	9

Figure 4.4: Chart display of educators' responses to whether they include the teaching of hazards and disasters in their learning areas

4.5.1.3 Educators' response to whether they use an integrated teaching strategy to enhance learners' awareness of hazards and disasters



	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Teamed	18	13	15	13	8
Not Teamed	12	17	15	17	22

Figure 4.5: Chart display of educators' responses to the use of an integrated teaching strategy to enhance learners' awareness of hazards and disasters

The inclusion of this question in the study was motivated by the provision in the National Curriculum Statements that educators from different learning areas should implement an integrated learning programme, which implies that educators are expected to develop learning programmes across learning areas that will help learners to appreciate the interconnectedness of different learning areas. As in other questions, the responses were not so far apart if viewed together. However, if viewed in isolation or per province the picture is different. The outcome was that 44.6 percent stated that they were implementing an integrated teaching strategy by working with other educators to teach learners while 55.4 percent did not implement an integrated teaching strategy. The majority of Western Cape respondents indicated that they did not team up with more than twenty respondents or fewer than ten, confirming that they did team up to teach about hazards and disasters. North West Province and the Eastern Cape have more respondents that disagree. KwaZulu-Natal is on a 50/50 percentage basis while Gauteng seems to be implementing the integration with twenty four educators collaborating with their colleagues.

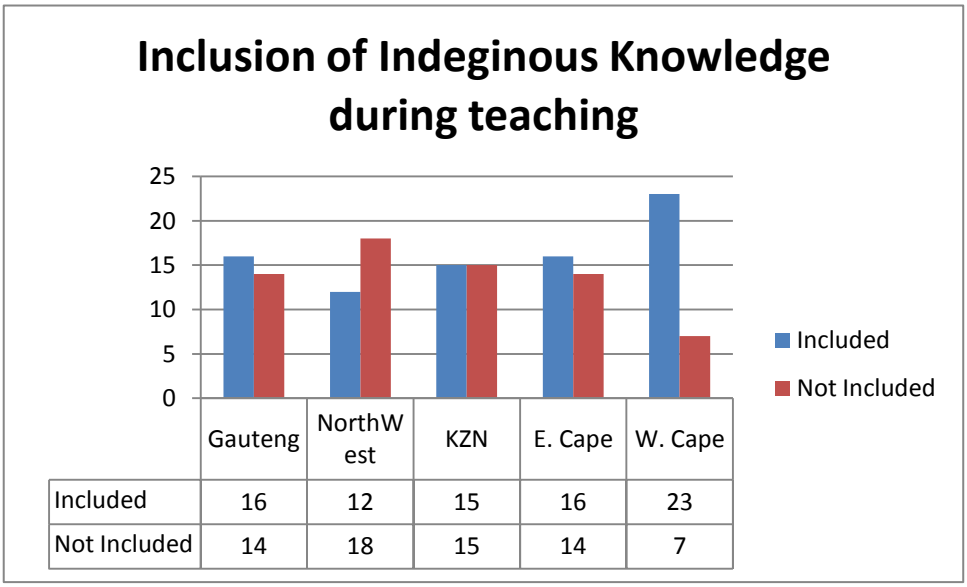
Follow-up questions were asked to educators who completed the questionnaires in my presence to determine how they implement the integrated teaching strategies. It emerged that the collaboration with other educators does not relate to the teaching of hazards and disasters but could be on any topic. HIV/AIDS emerged as the most favoured topic where educators from different learning areas collaborated. It emerged from follow-up questions from interview participants that even though an integrated teaching strategy was used in some schools, it was based on self-initiative and most of the time it was done between two educators without even designing a learning programme.

The conclusion from the responses to question 8 is that in three provinces, the Western Cape, North West Province and the Eastern Cape the teachers seem not to be teaming-up as much as they should as in Gauteng and KwaZulu-Natal. On the whole this implies that educators do not blindly follow the curriculum.

4.5.1.4 Educators' response on the inclusion of indigenous knowledge as a teaching strategy to enhance learners' awareness of hazards and disasters

The response to sub-question 6 is the direct opposite to that of sub-question 5 which reflect a 55/45 against 45/55 percent response from questionnaire respondents. While 54.6 percent of respondents supported the inclusion of indigenous knowledge in the classroom teaching 45.4 percent were against teaching learners indigenous knowledge. The response to this sub-question reveals that the majority of educators could be teaching indigenous knowledge or desire to do so. The data will be compared with the interviews and literature findings to synthesise the research findings.

The surprise in the pattern of responses that emerged from provinces is reflected in Western Cape educators' responses. More than 20 respondents from the Western Cape indicated that they included indigenous knowledge in their lessons. One would have expected KwaZulu-Natal, the Eastern Cape and North West Province to take a lead in this regard because of strong traditional cultures in these provinces.



	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Included	16	12	15	16	23
Not Included	14	18	15	14	7

Figure 4.6: Chart display of educators' responses to the inclusion of indigenous knowledge as a teaching strategy to enhance learners' awareness of hazards and disasters

4.5.1.5 Educators' comments on the inclusion of indigenous knowledge and integrated teaching as strategies to enhance learners' awareness of hazards and disasters

Regarding the matter of an integrated teaching strategy to enhance learners' awareness of hazards and disasters, only one respondent, (R13), commented by stating the following:

> *We do not exchange views as teachers in our schools or from schools to schools and therefore we do not have teams to develop integrated learning programmes.*

The remaining 149 educators were silent on the use of integrated strategies to enhance learners' awareness of hazards and disasters. Regarding indigenous knowledge two respondents, one from the Western Cape and the other from Gauteng, maintained that completing this questionnaire made them realise that there was a need to teach learners to talk to their families and this could include grandparents as well. To quote the respondent (R14) from the Western Cape Province:

> *I intend to teach learners more about hazards and disasters and exercise extra care about these concepts as well as putting more emphasis on teaching learners to talk about them to their families.*

The discussion below looks at the contribution of interview participants on the use of indigenous knowledge and integrated teaching strategies to enhance learners' awareness of hazards and disasters.

4.5.2 Interview responses on the inclusion of indigenous knowledge and integrated teaching strategies to enhance learners' awareness of hazards and disasters

The discussion in this section is presented starting with the inclusion of indigenous knowledge as a teaching strategy to enhance learners' awareness of hazards and disasters and then following by the use of an integrated teaching strategy to enhance learners' awareness of hazards and disasters. At the end of the section, a discussion of these two principles drawing views from the literature review findings is presented.

4.5.2.1 Interview responses to the inclusion of indigenous knowledge as a teaching strategy to enhance learners' awareness of hazards and disasters

From NCS, educators are expected to teach learners to value indigenous knowledge and interview participants were asked whether inclusion of indigenous knowledge would make a difference to enhancing learners' awareness of hazards and disasters. P1 responded by saying that any kind of knowledge that would enrich learners' awareness of hazards and disasters was welcome and that indigenous knowledge was important because elders could teach learners about the environment, using the moon and other environmental aspects; for example, when swallows fly in a specific pattern, elders know whether it denotes a storm or just an ordinary rain. If teachers and elders could discuss this knowledge with their learners' awareness of hazards and disasters would be enhanced.

P1 further elaborated on indigenous knowledge; while he thought that it was important, other factors should be considered when teaching indigenous knowledge. It should not be done at the expense of scientifically proven knowledge such as knowledge about lightning. According to some indigenous people, lightning originates from witch-craft and the only way to prevent it is to consult traditional healers. Lightning occurs with every thunderstorm and that there are different ways of protecting one from lightning. Any technique that could enhance learner awareness is welcome.

On how indigenous knowledge could contribute to learner awareness, P2 stated that there was a distinction between indigenous and local knowledge; the former is concerned with knowledge that reaches into the past and is rooted in people's culture. Local knowledge refers to a common understanding of things as they happen in a specific place. P12 provided an example:

> *If a person that resides in Johannesburg knows the weather, the dangerous place where they should not be at specific time and intervals. If a person from Pretoria visits Johannesburg, he/she will have to be made aware of the situation there as he will not be in the position to keep up with developments and patterns of weather.*

P2 emphasised that both indigenous and local knowledge are important in understanding vulnerability and hazards. Local knowledge is very important for learners because teaching could

be aligned with their environment. Indigenous knowledge could be used where it has been tested and found to be reliable. There is a great need to create awareness in a community rather than just waiting for schools to do the job.

Regarding indigenous knowledge, P3 mentioned that while this knowledge is important, it should be noted that scientifically developed knowledge is more important. Indigenous knowledge is a matter of cultural preference and if it works it is in order but it should not be emphasised more than scientifically proven knowledge.

P4 was of the view that indigenous knowledge is fundamental to learning because it does not only give wisdom but it makes learners connect and respect the traditional and cultural ways in which the older generation lived. I feel that this part of knowledge has not been integrated as it should and more work still needs to be done to make these connections. For this knowledge to be implemented in South African schools, other cultural sensitivity issues need to be considered that might raise questions in some schools. To some people traditional knowledge is not scientific and it depends on cultural beliefs which differ among South African cultural groups.

P5 reckons that indigenous knowledge is essential to learners as it makes them learn, appreciate and respect the contribution of cultural practices. If it had meaning to the old generation then it must be taught to learners, which makes indigenous knowledge important in classroom teaching.

P6 maintains that there is a specific focus on indigenous knowledge in some learning areas like Natural Sciences and Social Sciences. It makes sense to use indigenous knowledge on natural hazards. Hazards have been part of people's world for ever and people can read signs before disasters occur. For human-induced disasters, it will be difficult to use indigenous knowledge because these disasters are based on the risks of what communities do. For example, if we look at how people build houses and other structures on vulnerable areas, there is nothing learners could do and there is less chance that there will be indigenous knowledge to support people's resilience. P6 argues that if one considers the belief about solar eclipses which encouraged children to stay indoors, it has now been shown that if people look at the solar eclipse they might

become blind. To some extent, where the information is useful, it should be used to teach learners basic knowledge.

P7 confirmed the importance of indigenous knowledge by stating that it is important that different learning areas such as Natural Sciences make provision to integrate indigenous knowledge in classes, which allows for using disasters in that context. Cultural stories could be covered within the Natural Sciences learning area.

According to P8, the famous story told about a tribe that survived the tsunami by running to the mountains before there were visible signs of the danger to happen is misrepresented. The truth is that a young girl, who had just learned at school about the signs of earthquakes in the ocean, noticed the signs before the tsunami outbreak and informed the parents about the signs. Those who listened to the child survived but those who did not perished. The fact of the matter is that the knowledge that she shared with her parents and other community members was known and had been used before. The only problem with indigenous knowledge is that it is not documented nor tested; we need to work with old people who have this knowledge to preserve it through documenting it before they all die.

According to P9, if there are still people who have indigenous knowledge, they should be involved in training learners about old ways to deal with disasters. An example is the common method of extinguishing fire through using buckets of water. P 6 pointed out that when he was an emergency response officer, he noted that when people extinguished a fire with buckets of water before the arrival of fire fighters, it made a huge difference for fire extinguishers.

P10 responded that it is important to integrate indigenous knowledge into classroom teaching. It might be difficult for learners to grasp the essence of this learned knowledge. There are no longer grannies with that kind of information and those that could share the information, are not always reliable. Their knowledge was not documented and therefore it is disappearing or is no longer accurate.

While almost all participants agreed that indigenous knowledge is important for enhancing learners' awareness of hazards and disasters, there were some doubts raised by other respondents. They stressed the notion that indigenous knowledge is not tested scientifically nor documented and the bearers of this knowledge are disappearing. My impression here is that indigenous knowledge is disappearing because schools discourage learners from recognising the value of this knowledge. This became evident in a discussion with a teacher in the Eastern Cape while she was completing the questionnaire:

> *While at school, if a teacher asks a question and you answer it using something that you were told by either parents or grandparents, the teacher will make a joke of your answer which suggests that you are an idiot.*

This discourages learners from listening to their parents if they have not been to school or only attended lower grades. This notion is supported by a teacher in the Eastern Cape; it is difficult for learners to consult their grannies because they think that their grannies are not intelligent if they cannot write or read. This idea is captured well by Uy and Shaw (2008:62) who observe that in many cases traditional knowledge is regarded as primitive and therefore it is often discouraged or disregarded. For instance, the Ivatans school buildings were constructed without taking native wisdom into account. The project became an exercise in futility since no building remained after the passing of just a few typhoons. It is important to recognise the value of traditional knowledge, especially that which is time-tested and effective, despite modern-day technology.

While presenting seminars to Science educators in Mpumalanga during the National Science Week both in August 2009 and August 2010, I emphasised how a teacher's response can make or break a learner's future. I use the mathematical logic of 1 + 1 = 2; sometimes it is difficult for a child to comprehend this. I emphasised that sometimes it was difficult for me to see the logic because I was taught that a stick + a stick = 2 sticks and when the teacher was demonstrating I saw only two sticks. But when the teacher wrote the equation on the board, I saw more sticks and the answer to me could have been six, three, four or more. I tell seminar participants that some learners will not see the logic no matter hard they try to explain. When in contact with teachers, I have always encouraged them to teach learners to be innovative and think outside the box rather than to try and force learners who cannot observe logic. I emphasised to the seminar

participants that they were breeding smart criminals who wanted to prove that they were better than those who could see that 1 + 1 = 2. In actual fact we lose a lot of talent by not encouraging innovativeness at school level. Agrawal (2004:1) quotes Brokensha et al. (1980) who believe that to ignore people's knowledge is to ensure failure of development.

The dilemma that faces the interview participants is whether indigenous knowledge should be taught to learners even though it has not gone through a scientific validation process. This point has been raised by Agrawal (2004:2) when he states the following:

> *In accentuating the importance of indigenous knowledge, theorists of indigenous knowledge are caught on the horn of a dilemma. On the other hand their focus on indigenous knowledge has gained them an audible presence in the chorus of development, at the same time talking about indigenous knowledge commits them to a dichotomy between indigenous and western knowledge.*

Another critical point emerging from the interviews is that of the indigenous knowledge undergoing scientific testing which Agrawal (2004:4, 5) has raised as well when he states:

> *However, the ultimate irony in the attempt to valorize indigenous knowledge may lie in the willingness to adopt the methods and instruments of Western science. Most writings first propose the validation of indigenous knowledge by means of scientific criteria. If western science is the ultimate arbiter of knowledge then there seems little point in advocating the distinction between scientific and indigenous knowledge.*

Agrawal (2004:6) concludes by saying:

> *If the primary motive for highlighting the knowledge of the marginalised poor is to find them a greater voice in development, then it would seem preferable to foreground this objective rather than framing it in terms of the confounding rhetoric of indigenous v/s Western/scientific knowledge.*

The argument by Agrawal (2006) above should not be looked in isolation from what Briggs (2005:23) refers to as:

> *That the challenge will then be for proponents of indigenous knowledge to make a difficult choice between arguing for promoting indigenous knowledge as a radical alternative western science and knowledge, or instead negotiating a way into mainstream development practice.*

These discussions by Briggs (2005) and Agrawal (2004) relate clearly to sub-question 4, whether indigenous knowledge should be integrated into classroom teaching. Another alternative is to let indigenous knowledge develop as an alternative learning area and be taught outside the school environment to all learners. It was mentioned in Chapter two that the discussions of the conceptual framework that other scholars such as Rautela (2005), Stevenson (1996), Gaillard (2007), Gupta and Sharma (2006), Snively and Corsiglia (2001) and Hellier et al. (1999) support the idea of including indigenous knowledge as a teaching strategy that could enhance learners' awareness of hazards and disasters education.

From the discussion above it is clear that indigenous knowledge needs to be integrated into the schooling system provided the knowledge is documented and its relevance verified.

4.5.2.2 Interview responses to the use of an integrated teaching strategy to enhance learners' awareness of hazards and disasters

The participants were asked whether the use of an integrated teaching strategy would enhance learners' awareness of hazards and disasters. According to P1 integrated teaching is important because it would definitely improve learners' awareness of hazards and disasters and educators understanding of different disaster dimensions.

Regarding issues of integrating disaster education into the school curriculum and instructional design, P2 highlighted that although it is already integrated in the senior schooling phase, there is a need to start early and focus on hazards to avoid alarming learners unnecessarily. The participant propagated new ideas, but how to generate them was a challenge. A building block is needed first before teachers can be expected to move into a new mode of thinking. Where possible it would be beneficial to introduce this mode of teaching. Learners enjoy a new way of teaching but this is problematic in an environment where schools are expected to reach certain percentages and targets. The teaching of hazards education is not only essential at school level, it is even more important in institutions of higher learning in areas such as engineering, business studies, physical science, biological sciences and social sciences.

On the use of integrated teaching, P2 was concerned that we are bombarding educators with more and more work which will make it difficult for them and even confuse them. In her own words P2 stated that:

> *In an ideal world it would be perfect to include any new technique to improve learning, but thinking of our teachers out there, I think it is a huge burden to them, there is new curriculum they have to think of, making them play together is too much to expect, they do not have enough time, unless if we could train them to do all these things, we must not run before we can walk.*

This comment indicate that P2 is not for an idea of introducing any techniques but she acknowledged that the integrated teaching strategy could make a huge difference to learners especially on hazards and disasters her concerns are mostly on timing. In her own words she maintained that:

> *Other schools are doing this like private schools or the so called Model C and in formerly white schools they use team teaching on a daily basis but in your everyday school like Soweto it would be difficult to implement the strategy.*

P3 stressed that teamwork is important because people have different capabilities; multicultural dimensions bring in diversity. The emergency response model of teaching, which is similar to integrated teaching where lectures plan as a team in developing the curriculum, teaching learners and assessing them, would fit Geography well. This model of teaching could be integrated in other school subjects; for example, Biology, where one would explain how the body parts could be prone to damage by some hazardous material.

P4's view on integrated teaching is that it might be effective, especially where learners are taught the same topic by different educators. For example, the language educator could ask learners to develop a diary account of a disaster, the Natural Science educator would prefer them to look at gas emissions while the Economics and Management Sciences educator looked at issues of profit and loss related to a disaster. This type of teaching is ideal but whether it could be successfully implemented in Gauteng schools is questionable as educators have pressures to complete learning programmes and have much paperwork to do. Nevertheless there are schools that are already implementing some of the activities although not on a large scale.

Another participant (P5) mentioned that educators are used to working alone in classes and any involvement of other educators might disrupt and threaten their productivity. The integrated teaching strategy is not being implemented at the moment and as to whether it will have a positive effect on learners' awareness of hazards and disasters is questionable.

While most rural schools have not moved from the old paradigm of teaching, such as rote learning, some schools such as Dinaledi[3] schools have progressed well and are implementing outcomes-based education in its entirety. Organisational culture plays a crucial role in ensuring that some schools perform well while others perform poorly which makes it difficult for some instructional techniques to be implemented in schools.

P7 stated that an integrated teaching strategy is ideal because on a theoretical level it is easy to implement. However, on the practical level it would be difficult to be implemented because educators do not have guidance on how to use such strategy. Educators use textbooks as resource material as it is what they are trained to do and in most instances the books are the only source available. The challenge is that in some instance the specific learning outcomes that learners must achieve are not specified. The only prescription made is the outcomes that must have been achieved at the exit phase of the lower phase, the intermediary phase or the senior phase. Depending on the context in which learners find themselves, teaching about hazards and disasters could be included as additional resource materials.

According to P8 there are instances where integrated teaching could work and where it will definitely not work. In Mpumalanga there are some schools where there are large classes and one teacher has to teach more than two learning areas in that school. The integrated teaching strategy needs much time to plan and prepare and I doubt whether educators in Mpumalanga will be able to afford the time, especially as some teachers use public transport which has predetermined time schedules. Educators have been complaining of an overload considering that they have to do some administrative work and teach at the same time and they are currently battling with OBE

[3] Dinaledi Schools initiative is a project where schools are earmarked for further developing and increasing the number of promising students in Maths and Science as well as improving the teaching of Mathematics and Science in those schools

and the NCS's implementation. I think the strategy could work well for multi-grade classes where educators could plan as a cluster and take ownership of their work.

P9 stressed that teaching of learners about hazards and disasters should be a two-way stream where parents first teach their children before they go to school and during their schooling year they should reinforce the teaching that they get from schools. Educators should always be prepared to broaden the minds of their learners and make them aware that they are always vulnerable to various disasters; they should always keep an open mind that danger could face them any time. Educators themselves should seek help from other specialists in the area.

P10 strongly feels that although hazards and disasters are integrated into the school teaching programme especially for Grade 7 Social Science, the Mpumalanga Department of Education is not doing much to ensure the effective integration of information on hazards into teaching. There is a need to teach learners more about environmental issues such as pollution and mining sinkholes in the early grades. Grade 4 would be the appropriate level to introduce disaster concepts. Especially at that early age kids are good at teaching their parents about what they have learned at school. P10 prefers a combination of strategies to teach children.

P10 added that in some schools teachers travel distances to their work and use public or shared transport which makes it difficult for them to spend more time after school to plan their teaching. Integrated teaching is ideal in such cases but there is no way in which it would be successfully implemented considering the experience with outcomes-based education, Curriculum 2005 and National Curriculum Statements in the province. However, there is a need to spread the gospel of awareness of hazards in their environment, and learning how they can survive disasters. Integrating hazards and disasters into teaching would make a huge difference and teachers could organise their teaching around themes such as HIV/AIDS and pollution as starting points.

The next section will focus on whether the participants provided conclusive data to determine the extent to which indigenous knowledge and integrated teaching strategies would enhance learners' awareness of hazards and disasters.

4.5.3 Discussions of how indigenous knowledge and integrated teaching strategies enhance learners' awareness of hazards and disasters

The evidence that emerged in this section suggests that while respondents acknowledge that indigenous knowledge and integrated teaching are important in enhancing learners' awareness of hazards and disasters, there is some doubt about educators being ready to implement them. Most of the concerns raised relate to educators not having time to implement the strategies, the fact that they would be overburdened and that they have not been empowered adequately to take up these new challenges. If these reasons are considered, then the role that the NCS envisaged for educators as key contributors of education transformation in South Africa is far from being achieved. It seems as if some respondents doubt whether educators are capable of fulfilling various roles, such as mediators of learning, interpreters and designers of learning programmes and materials, scholars, researchers and lifelong learners.

There is enough evidence, however, to indicate that the respondents, although they have some reservations regarding integrated teaching, nevertheless support the idea of using integrated teaching. R2, R3 and R8 pointed out that they were implementing this strategy in their environment and it is producing marvellous results at institutions of higher and further education. R10 was confident that if implemented integrated teaching wouldl help educators who teach multi-grade classes as those educators would be able to plan together and teach learners the same content but assess them based on individual outcomes. R7 stressed that integrated teaching is consistent with OBE objectives and would work well to anchor OBE principles. Other respondents supported the idea and listed some important enablers such as school organisational culture, enhanced teacher training and more resources. This analysis of interview responses validate the educators responses results as outlined below.

Comparing the interview responses with the 55.4 percent response rate of educators who do not implement integrated teaching, it is without doubt that the reasons given above of educator overload and training would have a negative impact on the use of integrated teaching strategies. The percentage could be reduced if one considers that the respondents were not asked about the extent of their collaboration with other educators. Responses to a probing question asked of

educators who completed questionnaires in my presence showed that educators were not regularly using integrated teaching. Instead they were collaborating with not more than one as most of them indicated that they only did it once. The purpose of the sub-question was to determine the extent of awareness of integrated teaching and it seems that from 150 educators only 44, 6 percent are aware of the integration principles.

The literature is silent on integrated teaching as it is a new principle in South Africa; where it has been implemented there is not much peer-reviewed literature that reports on the principle. Some literature is discussed in Chapter two where researchers conducted empirical studies to determine the effectiveness of OBE and curriculum reforms in South Africa in relation to the principle of teacher collaboration or integrated teaching. Botha (2002), Jansen (1998 &1999), Fiske and Ladd (2005), Rogan and Grayson (2003), Rogan (2007), Cross et al (2002) and Vandeyar and Killen (2007) maintain that the curriculum reforms do not reach classroom teaching. The study was informed by scholars such as Arredondo and Rucinsky (1997), Ranby and Potenza (1999), Loepp (1999), Robinson and Schaible (1995), Venville et al (2001) and Gehrke (1998). The comment made by R6 on the role of school organisation culture of implementing integrated teaching is supported by Creese (2005) who maintains that the organisational structures in schools seem to discourage the culture of developing interaction and shared knowledge with fellow teachers.

The participants supported the concept of the integration of indigenous knowledge but pointed out the challenges concerning its inclusion in classroom teaching. One such challenge relates to the fact that the knowledge has not been documented anywhere and it will pose a challenge for educators to go looking for people with such knowledge. Other challenges include that since some of the knowledge has not been scientifically tested, it remains myth and if taught to learners it night mislead them or put them in danger. Lightning was used as an example; some indigenous communities believe that it is a source of witchcraft and the only way to counter it is consulting a traditional healer. In some instances examples were given which, if used, could raise learners' awareness of dangers associated with some hazards. Such examples include the one on the eclipse, the pattern of swallows' flight, reading signs of animals and living in harmony with the environment.

Literature was reviewed to confirm R8's account about a young girl who had just learned from her teachers how to recognise tsunami signs. When reporting this incident Rao (2007:8) said the following:

> *It is by now a well known story how a 10-year old British girl, Tilly Smith with her presence of mind and quick thinking saved about 100 lives on that day at one of the beach resorts in Phuket, Thailand. All she did was to alert people on the beach about the possible tsunami, when she saw a bubbling on the water, right on the edge and foam sizzling just like in the frying pan which she had leant in her geography class a few days before.*

In conclusion Rao (2007) argues that while people were complaining that there was no tsunami warning system in India, the British young girl provided evidence that it was a failure of mind rather than an absence of machinery, and simply put it that it was a lack of tsunami education that led to the deaths of several thousands in India on that day.

According to the questionnaire results 54.6 percent of educators are aware of the need to include indigenous knowledge in their classroom teaching. Not all have included the knowledge in its entirety, or they mentioned in passing some aspects of indigenous knowledge. From the results one can conclude that there is at least some form of awareness of integrating this knowledge in the classroom.

The literature on the effectiveness of indigenous knowledge implementation is silent and the only data available are debates on whether the knowledge should be introduced in classrooms or not. The most important aspect to note here is that through NCS, the South African education policy accords a special value to the knowledge and emphasises that if learners are taught at an early age they will be able to contribute to the development of indigenous knowledge as a part of scientific knowledge. Some scholars such as Gupta and Sharma (2006), Agrawal (2004), Stevenson (1996), Hellier et al. (1999) and Gaillard (2007) are concerned that this knowledge is disappearing even though it has a lot to offer to enhance learning.

My impression is that these two strategies would make a huge difference to improve the standard of education in South Africa if supported and implemented well. The literature review has provided relevant information in this regard. What remains is to go to the field and collect data

on best practices and as well as to conduct action research to determine the effectiveness of these strategies.

4.6 Empirical data collected to identify other teaching strategies that could enhance learners' awareness of hazards and disasters

According to the Hyogo Framework for Action 2005 – 2015 (2005:9) countries are expected to promote the inclusion of disaster risk reduction knowledge in relevant sections of school curricula at all levels and in the use of other formal and informal channels to reach learners with information. The purpose of sub-question 5 is to determine whether there are any other teaching strategies that could be implemented, apart from the inclusion of indigenous knowledge and the use of integrated teaching.

4.6.1 Educators' response to the question on what other teaching strategies could enhance learner's awareness of hazards and disasters

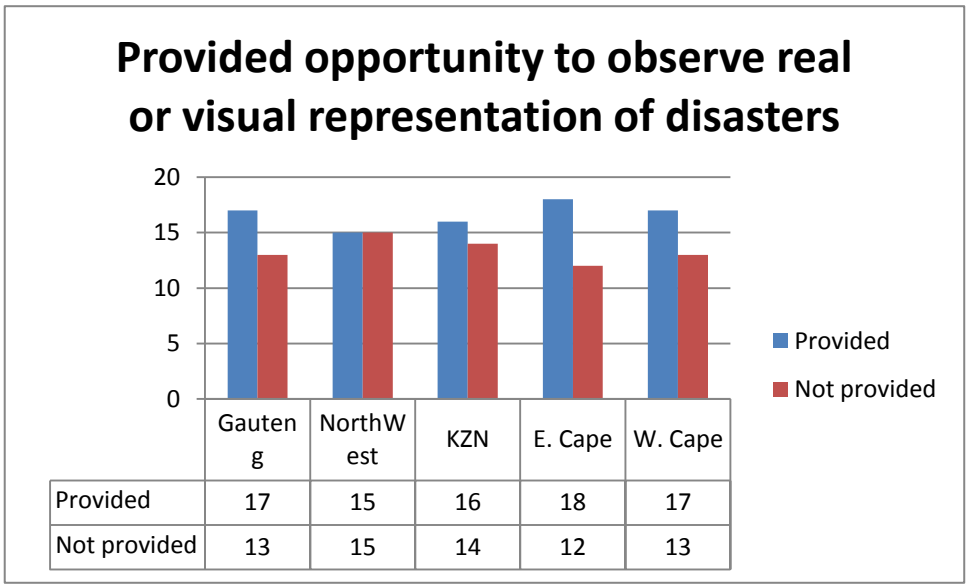
The intention of sub-question 5 is to identify other strategies that could enhance learners' awareness of hazards and disasters. The respondents were asked to tick whether they have used pre-identified strategies in their classroom to enhance learners' awareness of hazards and disasters.

Four questions were asked in relation to sub-question 5, which probed whether educators exposed learners to observing visual representation of hazards and disasters, whether they were taught to identify hazards in their area whether they were encouraged to talk to their parents. The analysis of responses to this question was done in conjunction with data displayed in Table 4.3 above. According to the results of those two questions, 99.3 percent of respondents agree that hazards and disasters should be integrated in school teaching while 79.7 percent indicated that it should be included across other learning areas. The question that emerges here is in what way the teaching of hazards and disasters should be taught to learners. This section provides data from educators as to what other methods they are using to enhance learners' awareness of hazards and disasters.

4.6.1.1 Educators' responses to the provision of an opportunity for learners to observe a real-life or visual representation of hazards/disaster incidence

Responses to question 5 are interesting, mainly noting the decline in responses and the notion that the responses are 55.3 percent affirmative and 44.7 percent negative. On face value one can conclude that 55.5 percent of educators from the five provinces do give learners real-life or visual representations of hazards and disasters while 44.7 percent do not. If the data are analysed per province this conclusion changes dramatically with other provinces being 60 percent affirmative and 40 percent negative with some even being to 70 percent affirmative like the Eastern Cape where 18 respondents answered in the affirmative and 12 in the negative. Some respondents were asked to show evidence of visual representation and in one school from Gauteng the respondents showed me drawings of disasters done by learners. Another school had a video of hazards and disasters while in one school in the Western Cape one respondent showed a picture from emergency services hanging on the wall with images of things that can burn shacks and a message of what learners could do to avoid accidents and other disasters.

If the matter is scrutinised closely, it becomes apparent that the respondents who have not taught learners about hazards and disasters are in the minority. If one consider that in question 4 on average seven respondents per province had not included hazards and disasters in their learning area, the implication is that approximately fifteen educators (on average) do give learners an opportunity to view visual representations of hazards and disasters while eight educators on average do not. The fact that educators who responded to the questionnaires were aware of the need to use different strategies to teach learners about hazards and disasters, gives hope that when a large scale implementation of the programme commences, educators would be familiar with the process as some had been involved.



	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Provided	17	15	16	18	17
Not provided	13	15	14	12	13

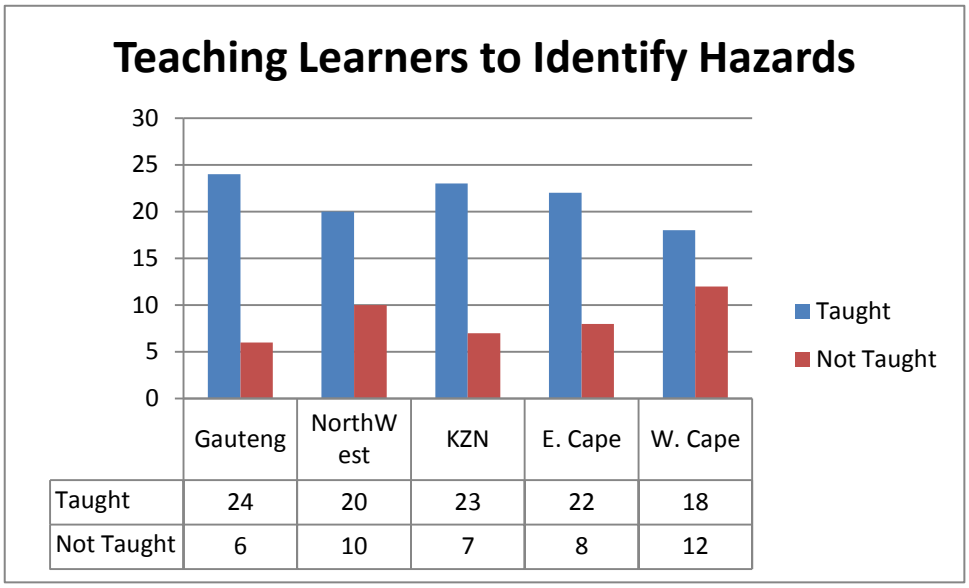
Figure 4.7: Chart display of educators' responses to exposing learners to observe real-life or visual representation of disasters

4.6.1.2 Educators' response to teaching learners how to identify potential hazards in their environment

Question 7 is similar to question 4 but phrased slightly different mainly to check if respondents were thinking about their responses. There are not many differences in the four provinces. North West Province respondents gave a different perspective from their question 3 responses. Whereas in question 4 twenty-five educators indicated that they do include hazards and disasters in their classroom teaching only twenty affirmed that they did teach learners to identify potential hazards in their environment. It could be that North West Province educators teach learners according to curriculum statements and do not reflect on hazards that are in their environment. This is evidenced by some comments from the province that educators are expected to teach learners about earthquakes and cyclones which are far removed from learners' environment.

The conclusion that can be drawn from question 7 responses are that 71.3 percent of educators who are teaching hazards and disasters value the need for learners to identify potential hazards in their environment; 28.7percent of those that reported that they do not teach hazards and disasters

did not see any need to help learners identify potential hazards and disasters. A closer scrutiny of the chart above reveals that Gauteng educators had a stronger need to help learners, while those in the Western Cape had less of a need. The results are surprising because Gauteng and the Western Cape have a greater prevalence of informal settlements and seem to be experiencing many hazards and disasters. Educators in the other three provinces, KwaZulu-Natal, the Eastern Cape and North West Province are more concerned with floods and road accidents than in Gauteng and the Western Cape that have fires and flooding as their concerns.



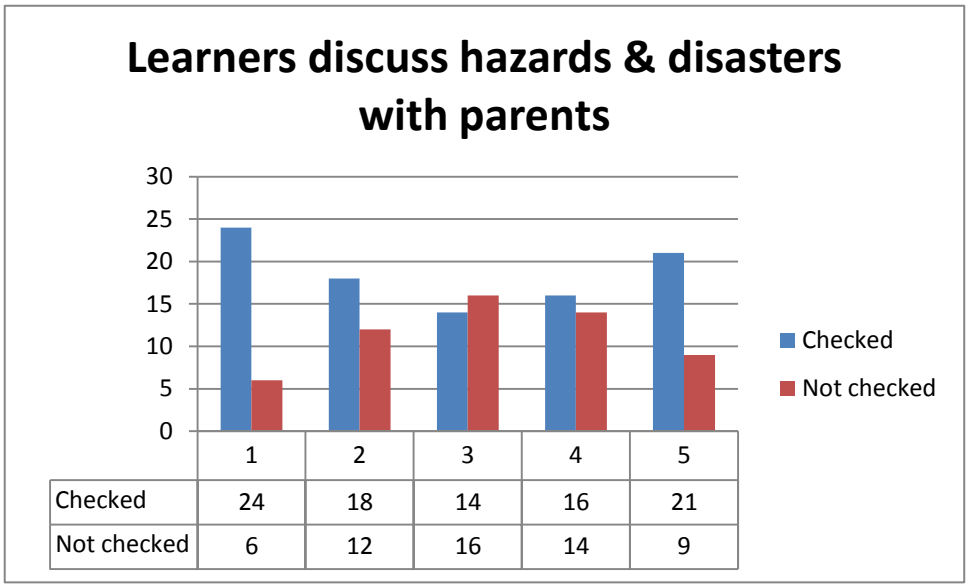
	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Taught	24	20	23	22	18
Not Taught	6	10	7	8	12

Figure 4.8: Chart display of educators' responses to teaching learners to identify potential hazards in their environment

4.6.1.3 Educators' response to checking whether learners discuss what they have learned about hazards and disasters with their families

Much educational research concurs that families play a critical role in enhancing learning. Regarding hazards and disasters, families could play an enormous part in creating awareness of hazards and disasters, starting with minor accidents or day-to-day hazards that are visible within their area. The response to question nine reveals that Gauteng and the Western Cape seem to be doing well in working with families as reflected by responses from Gauteng where twenty-four educators out of thirty do check whether learners discuss hazards and issues with parents while

in the Western Cape only 21 indicated that they do check whether learners talk to their families about hazards. KwaZulu-Natal, the Eastern Cape and North West Province seem to be close to a 60/40 split. The reason for these discrepancies between Gauteng and the Western Cape compared with KwaZulu-Natal, the Eastern Cape and North West Province could be that the first two provinces have bigger informal settlements with numerous hazards and have experienced most of these disasters while in the other three provinces, the hazards are not so visible and discussions depends on educators' discretion.



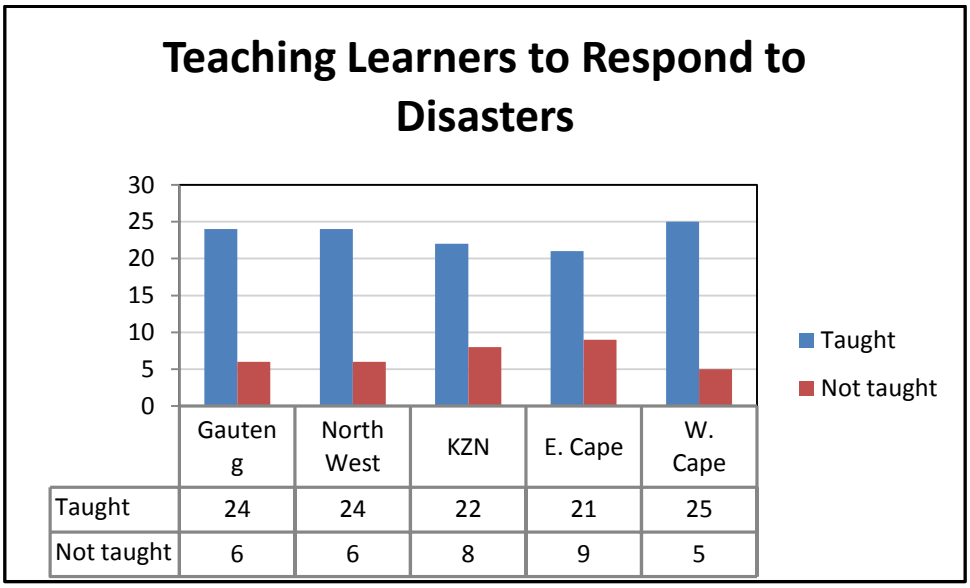
	1	2	3	4	5
Checked	24	18	14	16	21
Not checked	6	12	16	14	9

Figure 4.9: Chart display of educators' responses to checking whether learners discuss what they have been taught with their parents

The responses to this question indicate that 64.6 percent of the respondents do ask learners to discuss what they have learned with parents even though it is not related to hazards and disasters. Only 35.4 percent of the respondents do not involve parents in enriching their learning. The conclusion emanating from this analysis is that the majority of educators who completed the questionnaires are indeed aware of the value of involving parents in enhancing their teaching. The implication is that it would not be difficult to convince the 35.4 percent of educators to ensure that they involve parents in enhancing learners' awareness of hazards and disasters. It should also be noted that the percentage is limited to only those who responded and if it were to be applied to the country as a whole, the implication would be huge.

4.6.1.4 Educators' response to whether they teach learners how to respond when faced with disasters

Question 10 was included in the questionnaire mainly to check whether the respondents' understanding of questions 1, 2 and 3 is in fact related to the desired outcomes of the National Curriculum Statements. The response to this question from provinces varies considerably. Gauteng, the Western Cape and North West Province seem to be well ahead in teaching learners how to respond to disastrous events basis while KwaZulu-Natal and the Eastern Cape are trailing behind with an 80/20 split.



	Gauteng	North West	KZN	E. Cape	W. Cape
Taught	24	24	22	21	25
Not taught	6	6	8	9	5

Figure 4.10: Chart display of educators' responses to whether they are teaching learners ways in which to respond appropriately when faced by disasters

The percentage of educators who indicated that they do teach learners to respond to disasters is 80 percent. Considering additional comments from educators, it becomes clear that this percentage was due to the fact that educators talk to learners about road accidents, crossing rivers, playing with fire and even invite specialists to talk to learners about basic safety and first aid. It should be noted that the responses of educators were not based on the full spectrum of disasters but on only a few incidents, some of which do not qualify to be labelled as disasters.

4.6.1.5 Comments from educators on the use of other teaching strategies to enhance learners' awareness of hazards and disasters

Although not asked specifically to comment on the strategies, some educators responded that they have invited fire department and traffic safety officials to train learners how to play safe. Another respondent maintained that learners are quite aware of disasters as they had observed a real-life incident in which a school was blown away by a storm and occasionally some homesteads had burned down while they were watching. A respondent from the Western Cape commented as follows:

> *I think learners should be exposed to various videos of disasters that are happening all over the world. Educational excursions should be implemented to these various places when these man-made or natural disasters occur randomly and learners should be taught how to protect themselves against these natural hazards.*

Other comments were made that they do not directly relate to teaching strategies but stress the need to excite learners as a respondent from Western Cape commented:

> *I have found it very challenging and interesting to teach natural hazards to our children and they seem to enjoy it.*

Another respondent from the Western Cape commented that resources must be made available to all and also the mother-tongue motivation should be used. A respondent from Gauteng commented that the main challenge to enhance learners' awareness of hazards and disasters is the involvement of parents in learners' activities. The respondent further commented that audio-visual aids would be useful and that prescribed books should focus on disasters happening locally.

4.6.2 Responses to the question of whether other strategies could enhance learners' awareness of hazards and disasters

The respondents were asked to identify other teaching strategies that could enhance learners' awareness of hazards and disasters and they gave a variety of strategies; some of them are similar to the ones included in the questionnaires. P1 stated that there is no need for educators to reinvent the wheel; they should use brochures developed by the NDMC, such as those on informal settlement fire awareness, extreme cold awareness, lightning awareness, thunderstorm awareness, flood awareness and drought awareness. Teaching should be relevant and stimulate learners so that they know what they should do when faced with disaster. The curricula should be based on real risk, not perceived risk to enable learners to apply the acquired knowledge in real life.

P2 maintained that although theoretical input is useful, experiential learning is important because it brings fun and excitement and stimulates many senses. P2 stressed that the best way for learners to benefit from learning is through being involved. If you are a learner, experiential learning is beneficial. P2 stated that when she teaches her learners they enjoy practical illustrations that she makes, She maintained that when she teaches learners about overpopulation, she demonstrated how uncomfortable it was to have two people in a space that could fit one person. P2 elaborated on this example as follows:

> *If you draw a square, after every one minute add one student in the square in few minutes they will quickly become uncomfortable as the space becomes smaller and smaller.*

It is important to expose learners to observe hazards and disasters in real life or in a visual representation. Learners should be given the opportunity to embark on study tours and to watch disaster movies such as the popular TV series of *Nature Unleashed Volcano, Storm, Earthquake, Fire, Landslide and Flood*). They could also be encouraged to watch other TV series such as the ETV *Seconds to disasters* where events leading to disasters captured on video and evidence from people who survived disasters are discussed. In some cases older people from the community could be asked to share with learners their experiences of dealing with disasters. P2 stressed that

we should go beyond the textbook, and make the mental shift to have many senses stimulated, not just eyes or ears. Learning should be made exciting through engaging all senses.

P3 is of the opinion that school learners should be taught basic safety principles and be encouraged to master emergency response measures even though they would be following their ordinary careers. To have volunteers who could be called up to assist if a disaster strikes in South Africa is important. For example, the military have volunteers while the police force has reservists who are called up when there is need to safeguard the country. The interesting part of the mission is saving lives and if there is a way to do that before any disaster it would save a lot of efforts.

Regarding teaching strategies, P4 mentioned that they should vary from school to school and area to area but educators could supplement textbooks with other teaching material such as tasking learners to share experiences of disasters they have seen on television, heard or read about and to collect newspaper clips of disaster news items. They could do mind-maps and narration of issues related to recent disasters. This type of teaching depends on the teachers' enthusiasm as they are the ones tasked with ensuring that learners grasp learning outcomes. It is part of outcomes-based education to teach learners beyond the textbook.

P5 believed that consistent underscoring of awareness is important; and role players can be invited to the classroom to give talks or demonstrate disaster-related content. Different grades should include issues related to disaster awareness that encourage them to understand what hazards are prevalent in their area. It is of the utmost importance that disaster education is formalised in the curriculum as it will compel educators to teach it at a different level. Teaching strategies such as including indigenous knowledge, integrated teaching and visual representation of disasters seem to provide better options to make learners aware. There are many things that need to be done if a high level of awareness is to be achieved which, amongst others, includes having full knowledge of the impact of disasters on learners, and ensuring that curriculum developers, advisors and educators from all learning areas meet at various stages of their work to ensure that the integration of hazard and disaster education happens at all levels. Doing impact studies of teaching or getting feedback from educators, using a targeted approach to the

vulnerable schools and getting in touch with all areas through school visits as part of the assessment practice and distributing printed materials on hazards and disasters that could be used as learning materials by learners will go a long way to raising awareness of hazards and disasters in schools.

P6 reckoned that hazards and disasters should feature prominently in the National Curriculum Statements. However, the challenge is to make sure that book authors interpret the curriculum correctly and design an appropriate learning programme aligned with textbooks. Teachers usually welcome what is ready and they do not go the extra mile to get additional resources.

Commenting on teaching strategies to raise awareness in learners in the classroom, P7 maintains that different teachers have different ways of teaching and children also have different strategies; it is most important to balance the attainment of outcomes with experiential learning. Each school has its preferred teaching strategies and teachers usually comply with the school policy. Rural schools need a strategy that fits the multi-graded teaching where you have learners doing Grade 3, 4 and 5 together.

P8 maintained that teachers must be aware of the Internet and computer games available free of charge that could be used by learners. Educators should do everything in their power to ensure that learners have access to relevant online resources. Learners' awareness could be enhanced using different learning areas such as Art.

According to P9, learners should not only be given explanations of hazards and disasters; they should be given practical examples of hazards and disasters and be taught about their own surroundings. Since teachers are sometimes not directly involved in disaster risk reduction, they need to be trained or they can invite a specialist from emergency response services to present lectures to learners. Pictures and drawings appeal to learners; to make learners understand complex issues of disaster risk reduction, they should be encouraged to play games related to disaster risk reduction. Through subjects such as Mathematics, schools should raise awareness of disasters by teaching learners how negligent actions could lead to disaster. Parents should be involved in sharing their knowledge and experiences of hazards and disasters with learners.

According to P10 teaching strategies should allow learners to grasp basic concepts, complete assignments and self-study projects, work on a collage with various pictures of disasters and depending on the level of learners, watch videos and take excursions. Any strategy introduced should consider the learning environment which in most cases in Mpumalanga boasts large classes; teachers do not have enough time to cover the syllabus or complete required administrative tasks.

It can now be stated that the participants provided adequate data to determine whether there are other teaching strategies that can enhance learners' awareness of hazards and disasters. The next section discusses how the questionnaires, interviews and the literature review have provided conclusive data to determine what other strategies could enhance learners' awareness of hazards and disasters.

4.6.3 Discussion on what other teaching strategies could enhance learners' awareness of hazards and disasters

Sub-question number five intended to find out from the respondents if there were any other strategies to enhance learners' awareness of disasters. Rogan and Aldous (2005:315) illustrate that the effective implementation of science education involves classroom interaction. Such interactions include presentation by a teacher, attentive listening by learners and engaging learners through demonstrations, specimen exhibition, using graphs and involving learners on everyday life activities, conducting site visits and inviting specialists to school. According to Rogan (2007:117) while educators are willing to use new teaching strategies, they do not have the know-how to design worth-while learning experiences. This observation is in line with Vandeyar and Killen (2007:112) who state that educators conceptualise teaching in ways that are consistent with the old educational paradigm and are unwilling to entertain any conceptualisation outside their past experience.

While the responses proved that 55.3 percent of 150 respondents affirmed that they do use real or visual representation of hazards and disasters in their teaching, 71.3 percent affirmed that they do

teach learners to identify reality, 64.6 percent of 150 respondents affirmed that they asked learners to talk to their parents and 80 percent of respondents do teach learners about responding to disasters. There are other variables that could affect the results of responses; this method could have been used for other topics, not necessarily for hazards and disasters; educators could select an option to make their teaching look good. Nevertheless, the study was an attempt to look at the awareness of educators in relation to these teaching strategies.

A look at what evidence surfaced from the interviews to address sub-question 5, revealed categories such as excursions, tours, real-life examples, practical illustrations, videos, drawings and games. The most important consideration is that learning should be exciting and get learners involved. Some of the strategies include involving parents, inviting an expert to the class and using materials developed by organisations working in a similar environment.

My impression here is that enough evidence has been provided to address sub-question 5 and that helpful insights have surfaced.

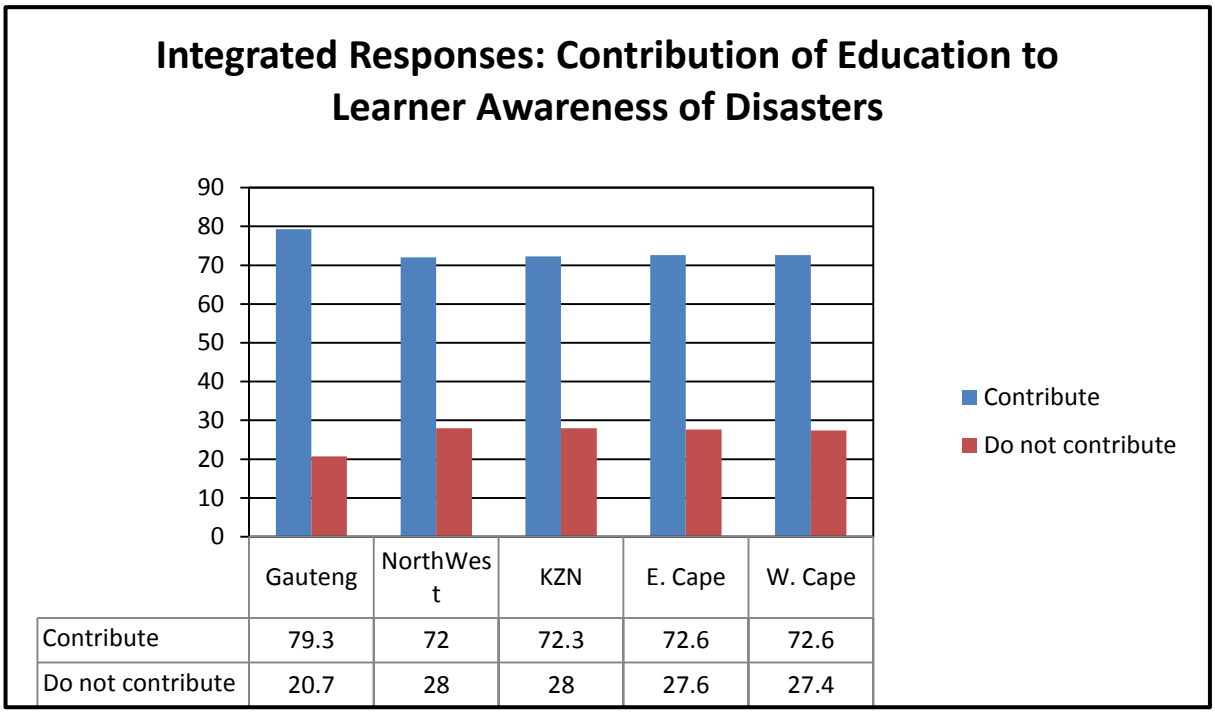
4.7 Discussions on whether the empirical data presented has provided conclusive evidence to determine how education contributes to learners' awareness of hazards and disasters

The aim of the study was to explore how education, in particular national curriculum and instruction design, contribute to learners' awareness of hazards and disasters. The discussions below will tap into some key points from the educators' responses, the responses from interview participants and the literature study to determine whether the main research question has been addressed.

4.7.1 Discussion of the educators' response in relation to the main research question

A total of 150 respondents were asked closed-ended questions to determine their awareness of hazards and disaster-related issues. It was argued in Chapter three that whereas dichotomous questions are not ideal for a PhD study; if combined with other qualitative methods as in this

study the combination of questionnaires to interview with 10 specialists, the validity of data can be enhanced. Below is the consolidated chart representation of educators' responses:



	Gauteng	NorthWest	KZN	E. Cape	W. Cape
Contribute	79.3	72	72.3	72.6	72.6
Do not contribute	20.7	28	28	27.6	27.4

Figure 4.11: Chart display of consolidated educators' responses to learners' awareness of hazards and disasters

The results above indicate that 73.8 percent of the respondents realised the need for education to contribute to learners' awareness of hazards and disasters. In view of some of the concerns raised about using closed-ended question especially the dichotomous ones, the findings of data collection through questionnaires do not provide conclusive evidence that education contributes to learner awareness of hazards and disasters. However, if the dimension of the literature review and responses from interviews with specialists are taken into consideration, the reliability of the evidence is enhanced. The section below discusses whether the additional comments provide any evidence that education contributes to learners' awareness of hazards and disasters.

4.7.1.1 Comments from questionnaire responses to whether education contributes to learners' awareness of hazards and disasters

The majority of comments were from the Western Cape Province with 19 comments, followed by the Eastern Cape with seven comments, Gauteng with six comments, North West Province with two comments and KwaZulu-Natal with only one comment. North West Province and KwaZulu-Natal registered few comments. The interesting part with regard to these comments is that they are not the same across the five provinces. In North West Province and the Eastern Cape, the majority of educators commented on road accidents, strong winds, and drought and to some extent flooding. KwaZulu-Natal commented on fire and accidents while in Gauteng the comments were about issues of curriculum and strategies to teach hazards and disasters.

Some comments from Gauteng and the Western Cape respondents raised a concern about the current National Curriculum Statements. Much emphasis is placed on disasters that are not common in South Africa such as earthquakes, volcanoes and cyclones.

What captured my attention was a comment by a respondent from the Western Cape who stated that he teaches learners about medical waste dumped in a nearby area where used needles are picked up by children to inject one another. My attention was captured because I had just read the *Star* newspaper which published an article about Khayelitsha residents who buy TB infected saliva so that they can access health grants for people infected by TB. The situation was also reported on by David Smith of the Guardian in UK as quoted below:

> *South Africans in an impoverished township are profiting from an illegal trade in a precious new currency - saliva. Tuberculosis sufferers in Khayelitsha, Cape Town, were found to be selling samples of their sputum to healthy people to pass off as their own in a scam to gain medical grants. An investigation by the West Cape News identified people with TB charging R50-100 (£4.10-£8.20) for saliva samples contained in bottles stolen from health clinics. The paper said that buyers of the samples were then able to get a card from a clinic indicating they have TB and use this to fraudulently obtain a temporary disability grant of R1, 010 per month from the department of social development. A 54-year-old man told a reporter that he makes an average of R500 per month from selling his saliva to people seeking to trick their way on to the benefits system. But he said business was "not good" because so many people were infected with TB in the township that he had a lot of competition. John Heinrich, chief executive of the SA National Tuberculosis Association, said: "It is definitely happening. People are trying to get a grant by pretending to be TB positive. Instead of handing their own sputum in, they buy it from*

> *people who have TB-positive sputum." He added: "They go to the clinics and get treated as TB patients. People are supposed to produce their sputum under supervision, but I'm sure when the clinics get busy, that doesn't happen." South Africa has one of the highest TB rates in the world with around half a million new cases each year, resulting in 78,000 related deaths. Poverty, malnutrition, HIV and cramped conditions in townships such as Khayelitsha, one of the biggest in the country, help the infectious disease to thrive.* (Guardian, 17 September 2009)

This article reminded me of my visit to one school in the same area (Khayelitsha) where I observed three learners struggling to bite the same ice-cream at the same time. A few minutes after the struggle one of the boys was coughing to such an extent that the other two boys laughed at him and one of them jokingly said “uzo khohlela igazi wena” which means, you will cough blood. I asked myself what if the boy was infected to a lesser extent by a flu virus or to an extreme extent by TB virus.

When I think of this incident I consider a comment by two educators in the same province who mentioned that since hazards and disasters are not mentioned in their schedules, it is therefore not necessary to teach learners about hazards and disasters. What if these boys were in the class of one of the teachers who felt that it was not necessary to teach learners about hazards and disasters? It simply means that these learners should wait until they are in Grade 7 to be taught about health related hazards so that they should not engage in activities that make them share saliva, especially with those that have symptoms of illness.

The health hazards coupled with vulnerabilities experienced by the Khayelitsha community as the picture below indicates, highlight the urgency of teaching about learners about hazards and disasters. The hazards depicted on the picture include high voltage electric cables with shacks beneath the electric poles and thousands of shacks grouped together without any space to allow for a vehicle to drive through, which imply that if there is fire in the area the fire trucks will not move through. Another challenge posed by the picture below is the dumping, and storm water pipe build by rocks. Having visited one school in the vicinity where this picture was taken, I felt that disaster education should be implemented as early as possible to help learners from the vicinity.

Picture 4.1: A depiction of vulnerabilities at Khayelitsha informal settlement

Impressive comments were made by some respondents across all five provinces that these questionnaires have brought awareness to them about issues that they never thought to implement when teaching learners; hazards and disasters and encouraging them to share with their parents. For example, some educators like the idea of including indigenous knowledge in their lessons and involving parents in the teaching of hazards and disasters.

In general, the educators' comments show a dire need for work schedules, textbooks and other learning resources to facilitate the teaching of hazards and disasters or what other participants call disaster risk reduction. There is a further indication that visits from fire and safety department officials could contribute to learners' awareness of disasters. Although the NCS should prescribe learning outcomes of what needs to be taught to learners, it is provincial and district education offices that should decide what must be taught in the schools. A respondent from the Western Cape suggested that hazards and disasters are experienced by learners especially in the area where the school is situated. In depth knowledge of how and what hazards

affect the community is crucial to empower learners to transfer what is learned at school to their community and household.

4.7.2 Discussions on how the interview responses addressed the main research question

Ten participants consisting of a senior manager from the South African National Management Disaster Centre, a professor of Geography from Wits University, a disaster management lecturer from Free State University, a lecturer from North West Province Emergency Response Training College and a team leader of the Rescue Mission to Haiti, a national curriculum coordinator from National Basic Education Department, a curriculum director from the Eastern Cape provincial education, and Gauteng, three Provincial curriculum coordinators from Gauteng, Northern Cape and Mpumalanga as well as a senior emergency response officer from Enviroserve who is also a former Ekurhuleni Metropolitan Emergency Response Officer were interviewed and provided rich data to address the main research question.

Some of comments from the participants related to the main research question are displayed below to complement the results of the questionnaire data from educators.

> *Build Social and intellectual capital by educating people to practice risk averse behaviour, making communities' resilience to disasters a priority by inculcating a culture of risk reduction.*

With this statement, P1 was simply appreciating that education has a crucial role to play, first by inculcating a culture of risk reduction, which in turn would lead to risk averse behaviour translated to social and intellectual capital. In short, P1 agreed that education contributes to enhancing learners' awareness of hazards and disasters even though there are many challenges that need to be overcome.

P2 on the other hand, has this to say:

> *Communities are always surviving; they learn from each other, it's all about how they survived. We teach Eurocentric views even though there are African ways that have stood the test of time; we do not have mechanisms to take up such knowledge and integrate it into our teaching.*

From the literature study it was noted that King (2000) strongly believes that everyone in the community must know how to deal with hazard, because the reality is that during an event, many thousands of people are actively involved in providing assistance to the victims of disasters.

With the fast rate of development in South Africa, where new urban settlements are being established daily, one wonders how much of the natural vegetation is being lost. Mulegeta et al. (2007:5) maintain that human-induced causes of flash floods include land degradation, deforestation of catchment areas, and increased population density along river banks, poor land use planning and lack of control of flood plain development. The panel of experts working with Mulegeta et al. (2007) further identified toxic waste disposal such as raw sewage, and incinerated ashes, contaminated oils, nuclear materials, acids and poisonous solvents ejected by chemicals, pharmaceuticals and fertilisers. They cautioned that the dumping of toxic waste materials poses a grave environmental threat to communities that are not aware of the dangers and are not equipped to handle the ensuing consequences.

Smith, Guastella, Bundy and Mather (2007:276) reported on the storms and cyclones that devastated the coastal regions of KwaZulu-Natal in 2007 and argue that the spectacular damage to property that took place on 19 and 20 March was a consequence of the building boom of the previous twenty years; they stress that the unprecedented destruction by the storm was due mainly to buildings being erected at the wrong place.

4.8 Triangulation of empirical and literature data collected to determine whether education contributes to learners' awareness of hazards and resilience to disasters

A good place to start in exploring whether education contributes to learners' awareness and resilience is to use the conceptual framework as a summary of issues emanating from the literature study such as distinction between hazards and disasters, vulnerability, resilience, indigenous knowledge and integrated teaching. It has been emphasised throughout the study that hazards are part of everyday life but they only become disasters if there is vulnerability. For example an earthquake can occur and not kill a single individual if people are aware that it might occur in their environment. They could avoid building houses next to earthquake-prone areas or

they could build structures that are resilient to the event. This is the same with fire, floods and droughts which are the main disasters experienced in South Africa. While most natural disasters cannot be prevented, the loss of life and property could be reduced through awareness and preparedness mainly dealing with vulnerabilities. Education has been hailed as a means to attain awareness and preparedness for disasters and also to attain resilience when disasters could not be avoided. Below is a table depicting the triangulation of data collected through the literature study, the questionnaire and interviews.

Table 4.1 Triangulation of data collected through interviews, questionnaires and literature

Themes	**Literature & Policy Documents**	**Questionnaires**	**Interviews**
Prevalence of hazards and disasters in South Africa.	South Africa like any other country is prone to many disasters with major ones consisting of floods, fires, storm, HIV/AIDS and accidents (road, rail and industrial)	Comments from educators revealed storms, floods, heavy rains, fires as disasters prevalent in South Africa	Floods, storms, fire, HIV/AIDS, chemical spillages, mist, road accidents and other epidemics have been identified as disasters common in South Africa. New insight that came though is that these hazards are not catastrophic if there is no vulnerability and also they become catastrophic when they become hybrid like the earthquake and tsunami that hit Japan in March 2011.

Vulnerability of communities in South Africa	Poverty is the key driver for vulnerability resulting in people residing in areas not suitable for human habitation. Informal settlements are the most vulnerable areas in South Africa.	There was mention of houses built using mud bricks, shacks and grass roof which made them vulnerable to heavy rains, storms, fire and lightning by questionnaire respondents.	Responses from the interview participants revealed that most of SA communities are vulnerable to disasters because some schools are located in river banks, learners have to cross rivers and busy roads to schools, learners use candles and coal fire which is not safe in houses built by shacks and that when there are accidents people including school children gather at the accident scene without understanding the nature of the accident which makes them vulnerable to chemical and other dangerous items.
Inclusion of hazards and disasters in the NCS.	Explicitly included in Grade 7 & 10 – 12 Geography Implicitly included in the Social Science learning outcomes –	98% of respondents agrees that it should be included	Almost all curriculum specialists agree that it is already included in the NCS (P4, P5, P6, P7 and P10) supported by P2.

	understand and demonstrate responsibility towards the environment		Although others did not explicitly agree to the inclusion, they did not have any contrary ideas.
The level in which inclusion should take place	The NCS policy documents indicate that hazards and disaster education is included in Grade 7 & 10 – 12. Also there is mention of environment, water issues and deforestations as well as mining and industrialisation.	Comments from some respond reveal that it should be taught to learners as early as possible.	Some of the participant indicated that it should start as early as possible, while some suggested grade 3/4 and some preferring it to be where it is. One participant mentioned that it should be taught even at university level
The nature of hazards and disasters content to be included in the curriculum	Natural, human-made and hybrid disasters should form the basis of hazards and disasters taught in schools.	The content should consist of local disasters and not emphasise on global disasters such as earthquakes and tsunamis.	Apart from the types of disasters, one participant indicated that basic safety issues such as first aid, fire safety. The teaching should go beyond the types of disasters and challenge learners to explore ways in which they can reduce the risks of disasters and to become resilient.

			Learners should be taught meaning of chemical symbols so that when there is a spillage, they should know how to respond.
Strategies used for teaching hazards and disasters	Educators should apply different strategies depending on the situation of learning. Integrated learning and the use of indigenous knowledge were regulated in the NCS as possible strategies. Integrated learning is suggested as the best technique to enhance learners holistic understanding of learning phenomenon (hazards and disasters)	Respondents were asked whether they think integrated teaching and indigenous knowledge should be used to teach learners about hazards and disasters which 44.6% affirmed positively that they apply integrated teaching while 54.6% affirmed that they apply indigenous knowledge.	While the integrated teaching seems to be appealing and has been successfully implemented in some of the schools in South Africa, in previously some of disadvantaged schools it will not make any difference as educators are over committed and are struggling to adapt to the new changes brought by NCS.
Other categories emerging related to the inclusion of hazards and disasters	Curriculum change in South Africa coincide with appointment of new ministers which should be exploited if a difference is to made.	There is a need to determine what housing structure learners come from and what type of settlements so that the disaster education	The teaching of hazards and disasters should be included in other subjects and also at university level and introduced across all subjects and

		programmes could be tailor made to suit	courses for example in engineering, economics and law etc.

4.9 Conclusion on the empirical data collection to collection to determine whether education contributes to learner awareness of hazards and disasters

The discussions in section 4.7.1 revealed that the consolidated responses of 73.8 percent of educators support the notion that education contributes to learner awareness of hazards and disasters. This analysis provides important evidence to argue that education does contribute to learner awareness of hazards and disasters. Almost all interview participants agreed that South Africa has a prevalence of disasters, that hazards and disasters should be integrated into the national curriculum from the early phase right through to senior phase and at universities. Also the response from the participants support multiple teaching strategies including integrated teaching and the inclusion of indigenous knowledge in the classroom teaching should be considered as a means to enhance learners' awareness of hazards and disasters even though some had reservation on the timing part for implementation.